DECEMBER, 1928

Railway Engineering and Maintenance

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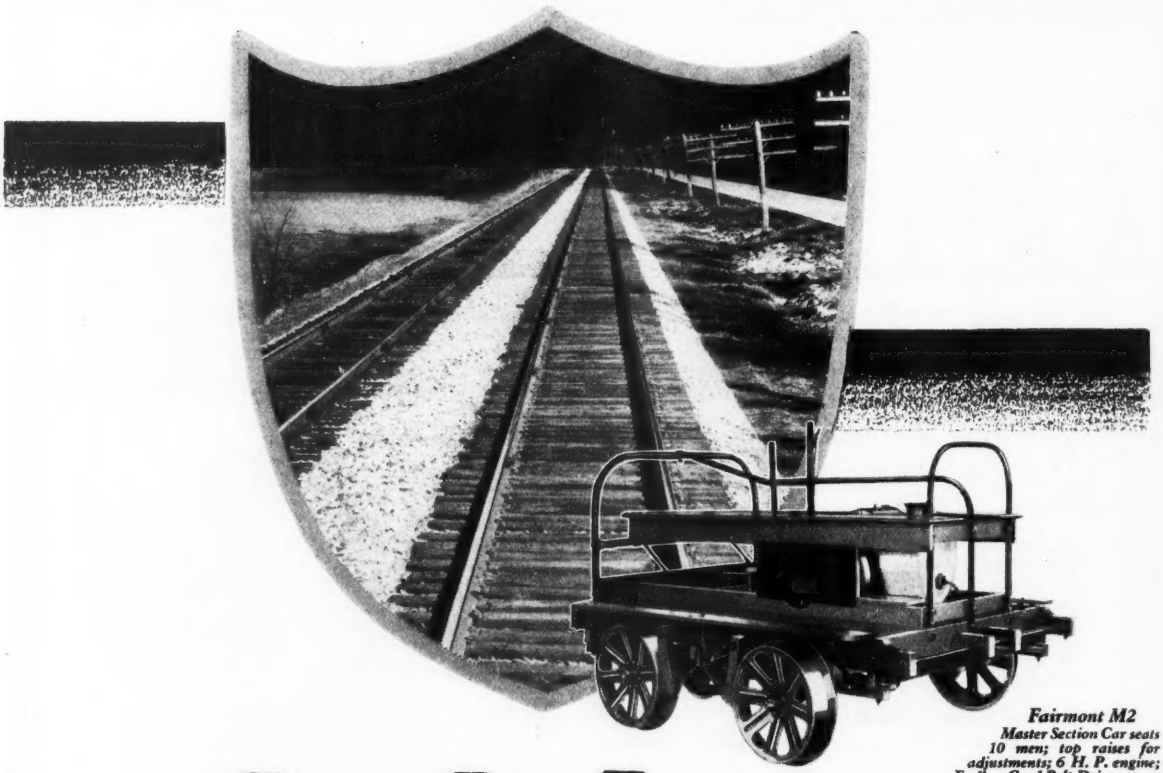

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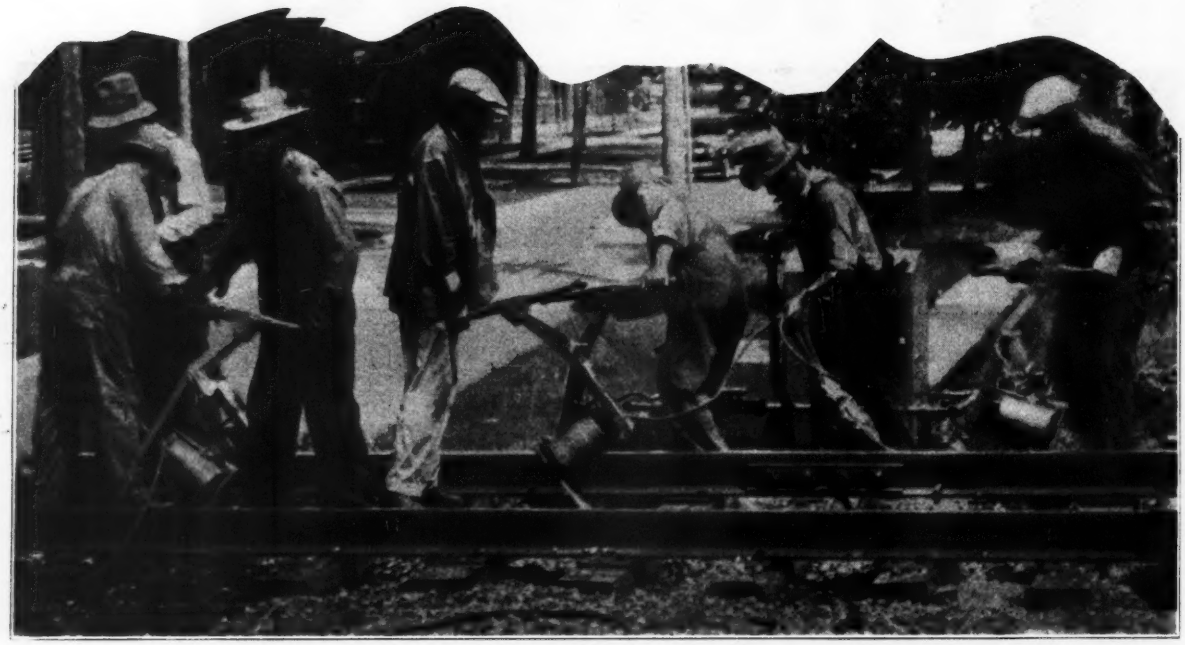

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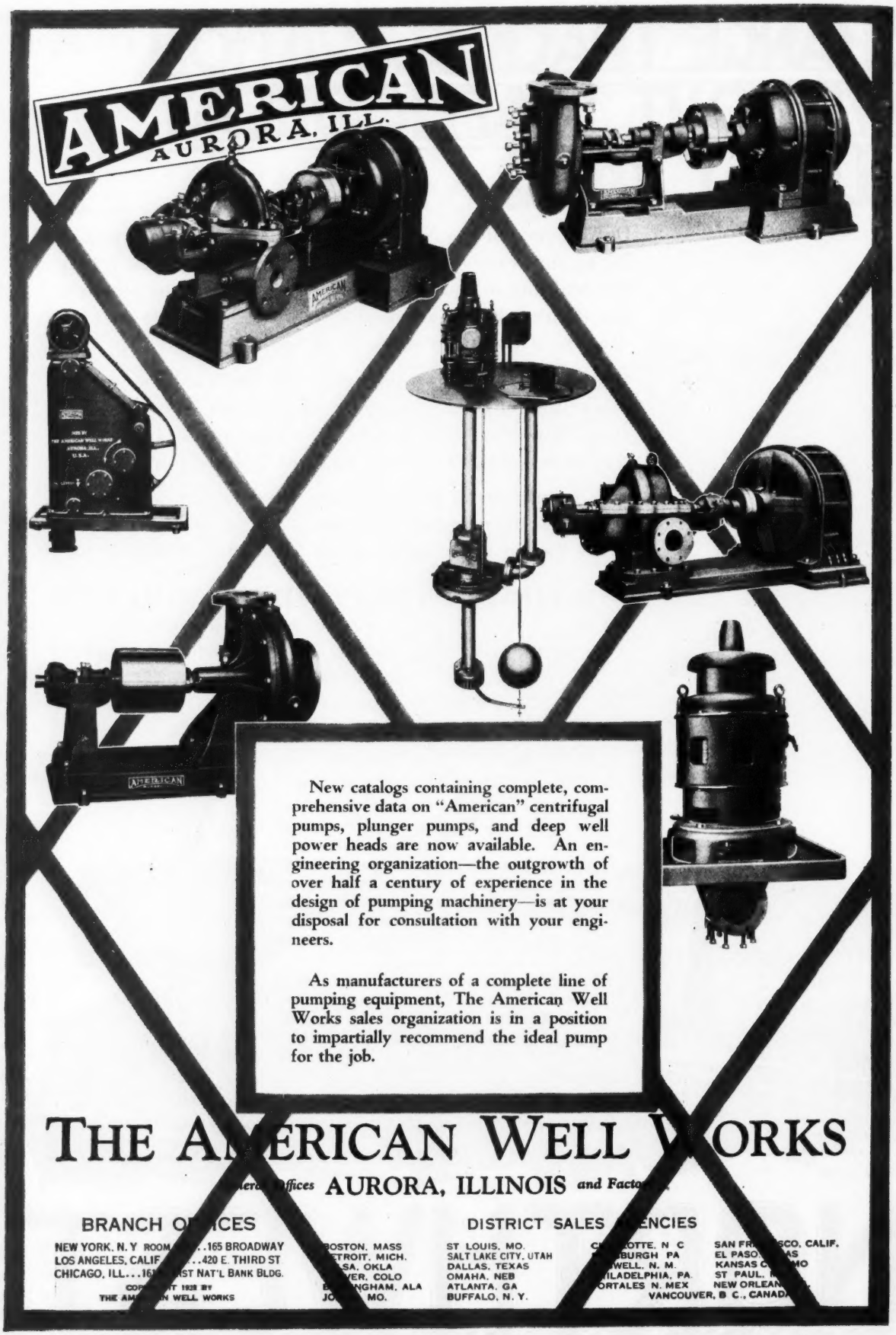

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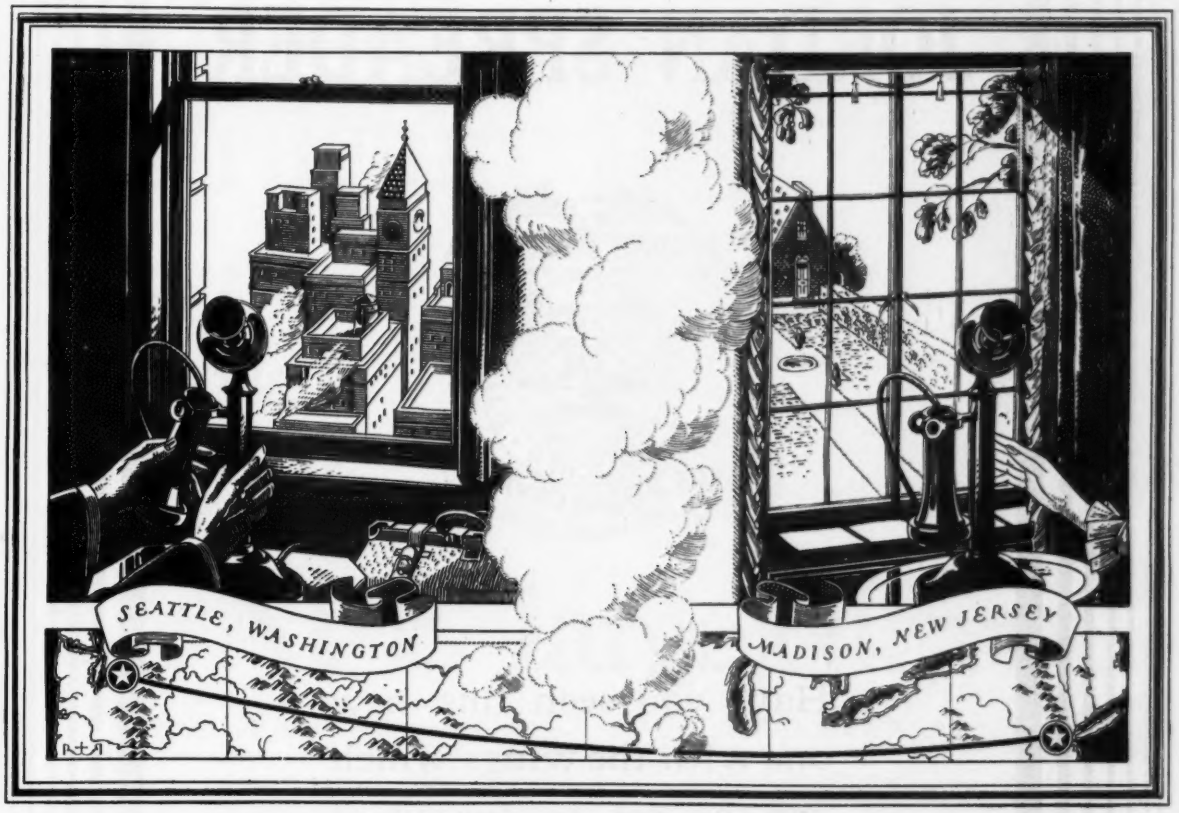

An Advertisement for Bell Long Distance Telephone Service

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By C. M. Kurtz

Assistant Engineer, Engineering Department, Southern Pacific Company

THIS new handbook on the design of standard track fixtures, turnouts, etc., is for location, construction and maintenance of way engineers, transitmen and draftsmen, in field and office.

The practical mathematical treatment of track layout and other problems is the outstanding feature of this book. These are *fully exemplified* and worked out in detail.

Mr. Kurtz has had more than twenty-five years' experience as a railroad engineer. The problems outlined are taken from actual pratice.

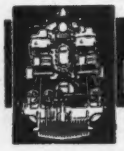
A. R. E. A. definitions of General Track, Split Switch, Frog, Crossing, Yard and Terminal terms appear in the respective chapters as listed below. Solutions of vertical curve problems are presented in three ways, all outlined in a simple manner, and thoroughly demonstrated.

Formulae and simple processes for computing the dimensions or elements of Slip-switches, Turnout and Crossing Layouts, the several kinds of Yard Layouts, in fact, all computing problems which may arise in TRACK ENGINEERING are treated in such ways as to be readily accessible and clearly understood.

The text is fully illustrated by over 116 drawings showing the best of accepted designs for fixtures and track layouts. Original tables which facilitate the solution of turnout location problems when the turnout springs from tangent and from the inside or outside of curved track are featured. Other original tables provided are the following: Reverse Curve Center Distances and Angles; Crossover Elements for Standard Turnouts, Nos. 6 to 16, inclusive, and for tracks 12 to 20 ft. on centers; Crossover Elements when Turnouts are of different Numbers; Simple Curve Elements and Formulae.

A complete set of practical railway engineering tables is also provided, including the following: Radii; Minutes in Decimal of Degree; Tangential Offsets; Long Chords; Mid-Ordinates to Long Chords; FUNCTIONS OF A ONE-DEGREE CURVE; Natural and Logarithmic Trigonometrical Functions, etc.

The book will prove invaluable to students as well as experienced engineers who realize the importance of having a large body of information, practically compiled, and in compact form ready for use.



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Definitions of General Track Terms—Design of Split Switches—Design of Frogs—Design of Movable Point Crossings and Slip Switches—Design of Crossing –Design of Split Switch Turnout Layouts — Turnouts Connecting with Divergent Tracks—Connecting Tracks — Wye Tracks — Siding Connections — Crossovers—Yard Layouts — Crossing Layouts — Solution by Traverse — Vertical Curves — Easement Curves and Superelevation—Tables.

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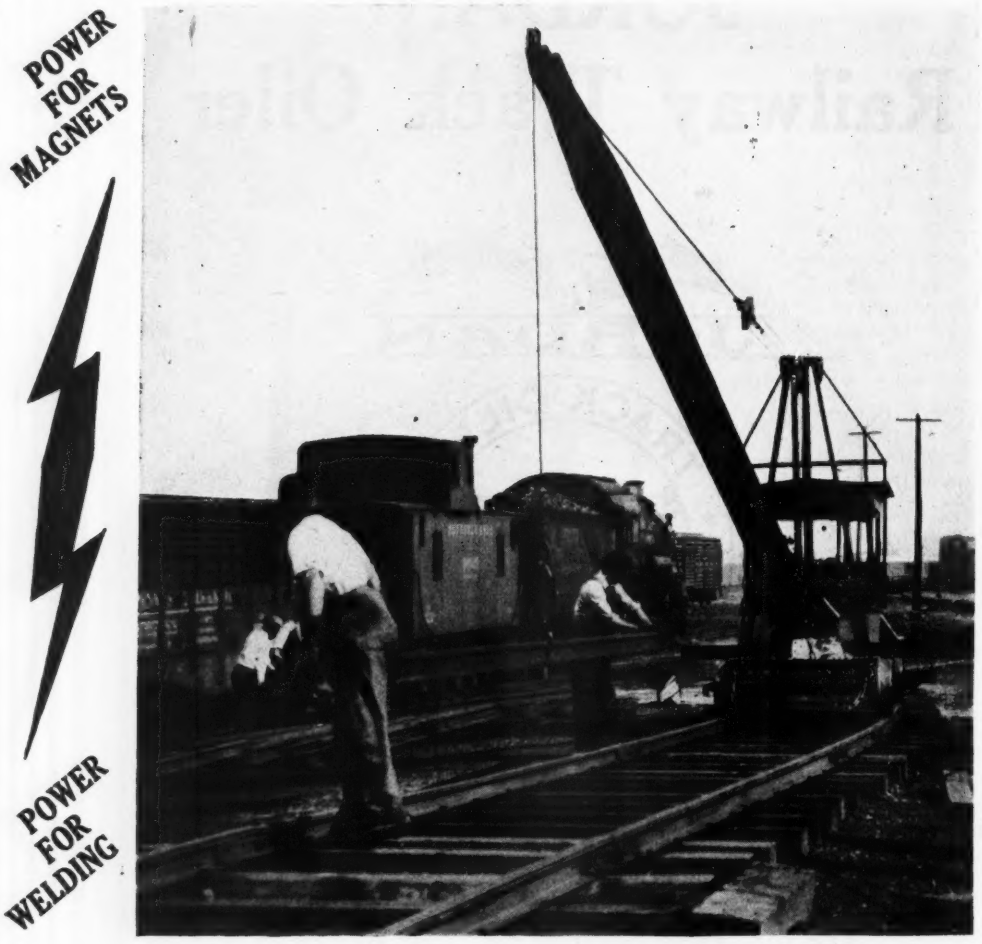

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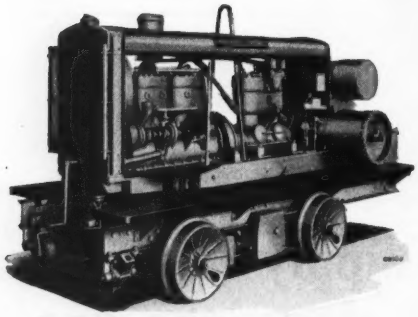

The Ingersoll-Rand Tie Tamping Compressor is a complete power plant. Three sizes are available, having, respectively, 4-, 8- and 12-tool capacities. They operate all kinds of pneumatic tools used in rail laying, bridge and building work.

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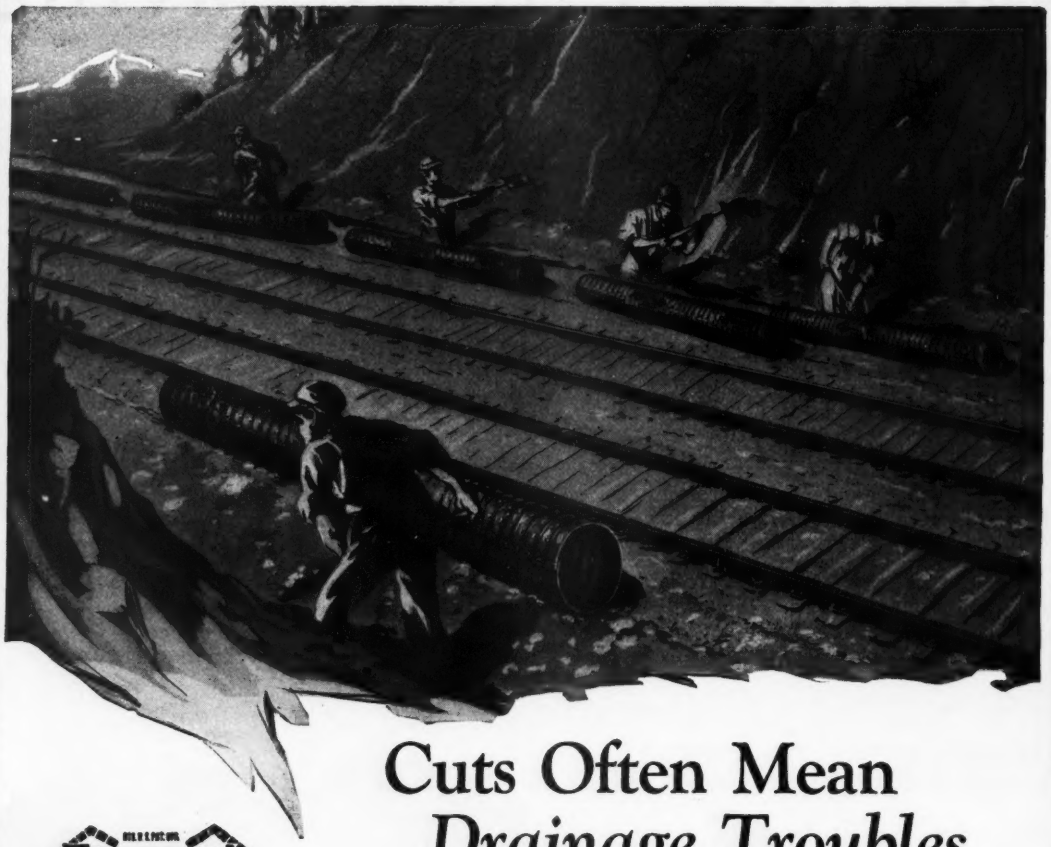
Concrete Products *for Over 25 Years*

FEDERAL 2 piece Concrete **CRIBBING**



Cuts Often Mean *Drainage Troubles*

TONCAN COPPER
Mo-lyb-den-um IRON

Following are the makers of Toncan Culverts. Write the nearest one:

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The Berger Mfg. Co., of Mass. Boston, Mass.
The Berger Manufacturing Co. Dallas, Texas
The Berger Manufacturing Co Jacksonville, Florida
The Berger Manufacturing Co. Minneapolis, Minn.
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The Canton Culvert & Silo Co. Canton, Ohio
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CUTS generally require provision for handling an unusual amount of water.

Ground water and springs are often intercepted and in addition the water shed by the shoulders of the cut must be carried off promptly.

Here is the place for Toncan Iron Type "B" Drains.

Placed in each side ditch and covered with ballast they carry off the water and keep the road bed dry.

Rows of outward-tongued perforations provide highest drainage efficiency while retarding the entry of dirt.

Consequently, this new drain is more free from dirt-clogging while long life is inherent since it is made of Toncan Iron.

Toncan Iron has the natural corrosion-resistance of iron fortified by alloying with copper and molybdenum. It will therefore last longer.

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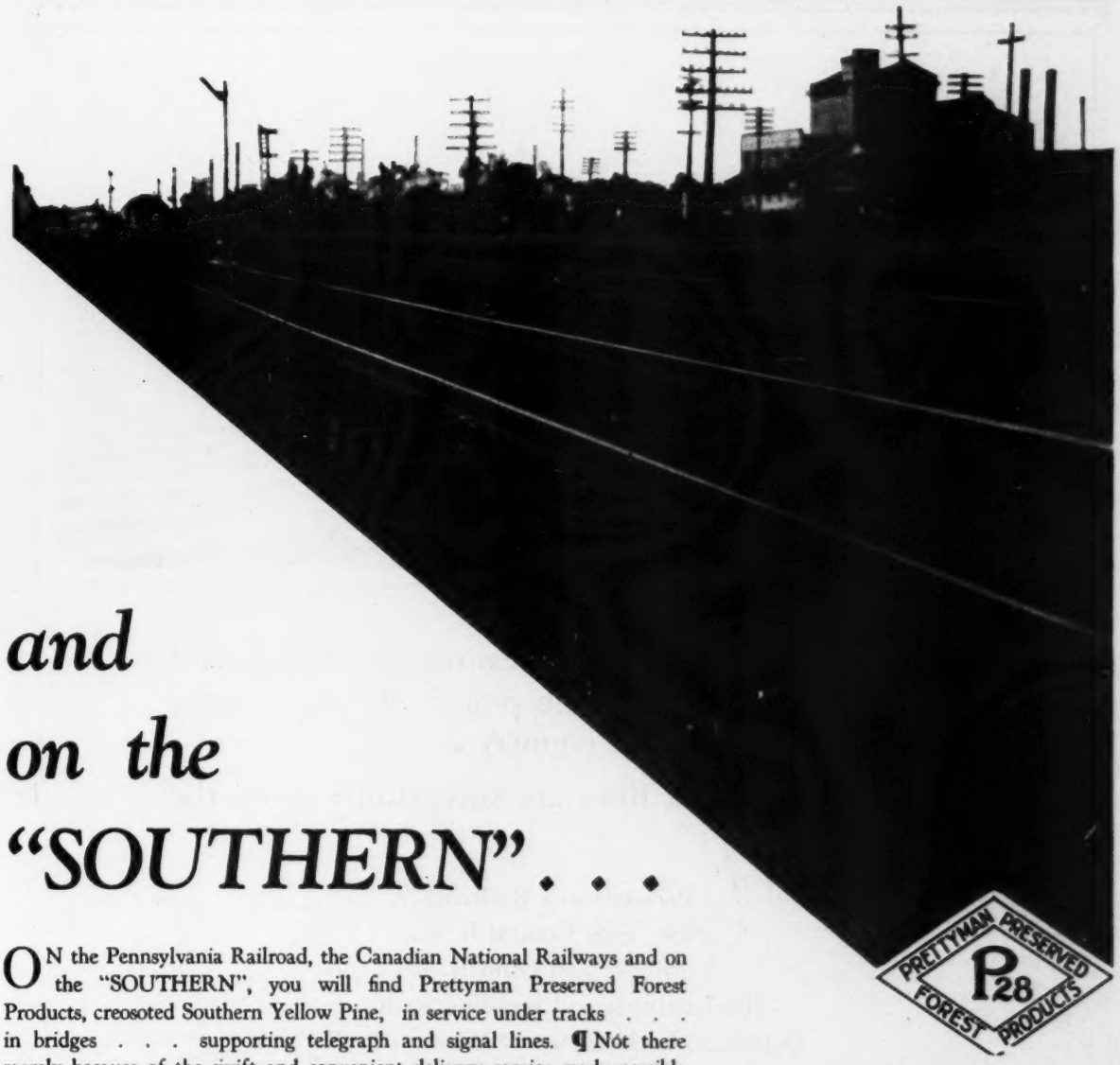


and on the "SOUTHERN"...

ON the Pennsylvania Railroad, the Canadian National Railways and on the "SOUTHERN", you will find Prettyman Preserved Forest Products, creosoted Southern Yellow Pine, in service under tracks . . . in bridges . . . supporting telegraph and signal lines. ¶ Not there merely because of the swift and convenient delivery service made possible by vast Prettyman raw material resources, the most complete and modern treating plant in existence, and excellent shipping facilities by both rail and water. ¶ There, first, because creosoted Southern Yellow Pine is the most economical and most efficient material yet discovered for railroad cross ties, bridge timbers, piling and poles. There because creosoted Southern Yellow Pine will render the greatest number of years of service per dollar of cost. ¶ There because Prettyman Preserved Forest Products are of sound, carefully selected timber, thoroughly and uniformly impregnated to the heartwood with oil of unquestioned quality. And because they more than meet the rigid specifications of these experienced and careful buyers of structural and maintenance materials.

Above: Prettyman Preserved Ties of Southern Yellow Pine were used as replacements in the Charleston, S. C., Division of the "SOUTHERN". Note how a new tie has been placed on either side of each usable old tie. The Prettyman plant has even fabricated and treated water tanks for the "SOUTHERN".

J. F. Prettyman & Sons
Wood Preserving Plant
Charleston, S. C.

THE McWilliams Mole is cleaning the ballast and perfecting the drainage on practically every stone ballast railroad in the country.

All of these trunk lines are successfully using the "Mole":—

Pennsylvania Railroad
New York Central R. R.
Baltimore and Ohio R. R.
Philadelphia and Reading R. R.
Deleware, Lackawanna & Western R. R.
New York, New Haven and Hartford R. R.
Central R. R. of New Jersey
Pittsburgh and Lake Erie R. R.
Norfolk and Western R. R.
Boston and Albany R. R.
Southern Pacific R. R.
Erie R. R.

RAILWAY MAINTENANCE CORPORATION
PITTSBURGH, PENNA.

◆McWILLIAMS MOLES◆

EVERY MAINTENANCE OFFICER

should investigate
the

"TELEWELD electric PROCESS"

Rail End Reclamation by the modern, efficient method.

"IT HAS BEEN PROVEN"

Obtain—Riding qualities of new rail.
Defer—Laying new steel.
Minimize—End flow of metal.
Eliminate—Fractured joints.
Stop—Costly rail "cropping".
Lessen—Maintenance costs.
Reduce—Wear of joint ties.
Save—Joint bars.

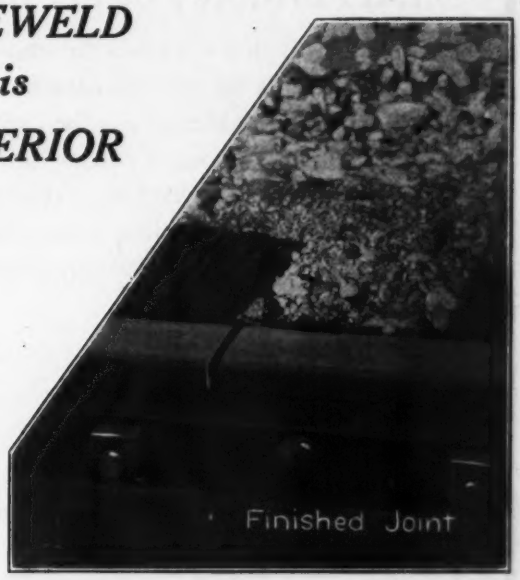
TELEWELD
is
SUPERIOR

Five years of satisfactory performance support our claims.

Surveys of your rail made at our expense.

Complete details furnished upon your request.

Investigate.



San Francisco
952 Howard Street

Salt Lake City
Continental Bank Bldg.

ELECTRIC RAIL WELD SERVICE CORP.

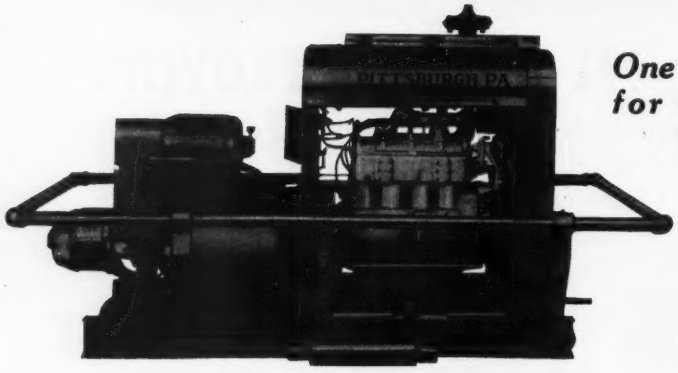
Denver
2101 Blake Street

RAILWAY EXCHANGE BUILDING, CHICAGO

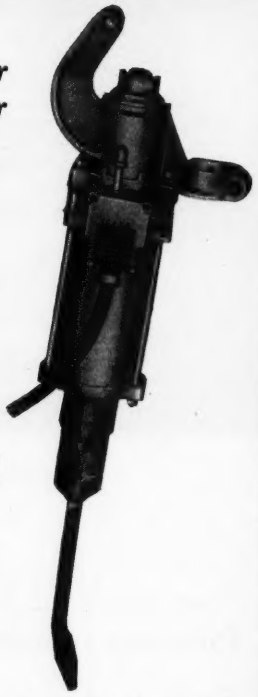
Spokane
Old Nat. Bank Bldg

"TELEWELD COMPLETE SERVICE"

THE SYNTRON TIE·TAMPING OUTFIT



One Controller for 6-Tamper Outfit



Small Portable Power Plant

Provided with dolly wheels for moving along rail. Skids on side for ease in sliding off rail to shoulder of roadbed where it rests. Easily lifted by four or five men. No special cribbing required. Power unit only 20 inches wide—operates a large number of portable electric tools.

Self-Cooled Tamping Tool

Each SYNTRON Tie Tamper delivers 1500 powerful blows a minute, every minute of its operation. The tamper is self-cooled—positively no danger of overheating. Comparatively light in weight. Easily handled.

250 ft. Light Flexible Cable

Electric armored cable of standard grade and weight gives a 500-ft. working range from the power plant.

Small Controller

The control and distribution box is only 18 inches long, 11 inches wide and 12 inches high. No glass bulbs. Only one moving part. Standard fuses and simple cable connections.

The power plant, controller and cable with this outfit is capable of operating a six-tamper outfit and for running a large number of portable electric tools.

SYNTRON COMPANY — PITTSBURGH, PA.

SYNTRON

Tie Tamping Outfits and Portable Power Tools

The Mark of Dependable Property Protection

© C. F. Co. 1928

HOW BIG IS YOUR *Fence Dollar?*

The fence dollar, like the food dollar, the clothing dollar and other familiar dollars has a variable value, depending on when and where it is spent.

But unlike most other dollars, the value of the fence dollar is little understood. Buyers, unfamiliar with fence materials and fence erection, often accept specifications such as height of fence and measurements of parts, as an accurate yardstick of value. Frequently, too, they compare prices with a finality that leaves little room for consideration of quality.

On this basis, no fence dollar can buy maximum value. Specifications have many fatal loop holes. Samples may side-step a multitude of sins. Prices are never a reliable guide.

To judge fence properly, you must step outside the dangerous triangle of specifications, samples and prices and gather facts on many other essential points. Find out about weights of materials, shape and size of posts, design of gates, depth and shape of concrete post foundations. Make sure that fresh, new materials will be used. And, of utmost importance, who will erect the fence? Will it be a neat, workmanlike, first-class installation? Can the company who sells the fence take Complete Responsibility?

Cyclone Fence has become the nation's standard by right of its inherent quality. Cyclone Fence is priced reasonably low yet Cyclone never has been, and never will be, a "price proposition."

Call a Cyclone Representative

Learn why Cyclone Fence provides property protection at lowest cost per year — maximum value for every dollar invested. Cyclone factories, warehouses, and direct factory branches are located at points throughout the United States to afford quick, competent, complete service in every locality. Wire, phone or write nearest offices.

Fencing for factories, schools, playgrounds, residences, estates, property of all kinds.

Cyclone Fence

REG. U.S. PAT. OFF.

CYCLONE FENCE COMPANY, *Main Offices*: Waukegan, Ill.

Works and Offices:
North Chicago, Ill., Greensburg, Ind., Cleveland, Ohio, Newark, N. J., Fort Worth, Texas, Tecumseh, Mich., Oakland, Calif., Portland, Ore.

Direct Factory Branches: Atlanta, Baltimore, Buffalo, Charlotte, Cincinnati, Des Moines, Detroit, Hartford, Conn., Houston, Indianapolis, Jacksonville, Fla., Kansas City, Mo., Milwaukee, Mineola, N. Y., Minneapolis, Mount Vernon, N. Y., Philadelphia, Pittsburgh, St. Louis, Syracuse, Toledo, Tulsa.

Pacific Coast Division: Standard Fence Company, Oakland, Los Angeles and San Francisco, Calif., Portland, Oregon, Seattle, Washington.

A GREAT SAVING--

That's what makes Coover Braces count--

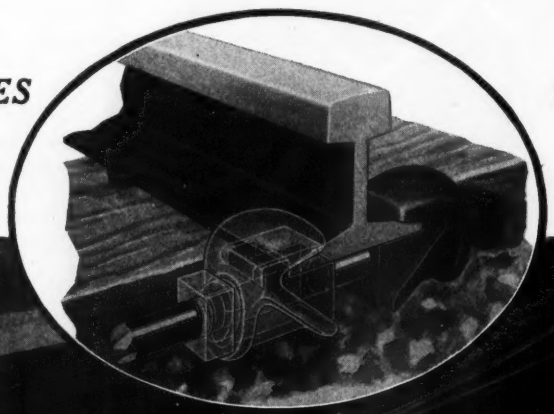
To prevent the splitting of switch shown below,—tieplates were formerly sufficient. The increased heavy and fast moving rolling stock however, made this switch a constant source of trouble and expense.

Since Coover Braces were installed three years ago, this point has withstood every stress brought upon it.

What trackman does not have at least one switch or curve on his division that absorbs most of his "man hours" and material?

You can save the money spent for material and labor at these points, by securing them in the vise grip of Coover Braces. Moreover one derailment will cost you more than the cost of Coover Braces to secure such points.

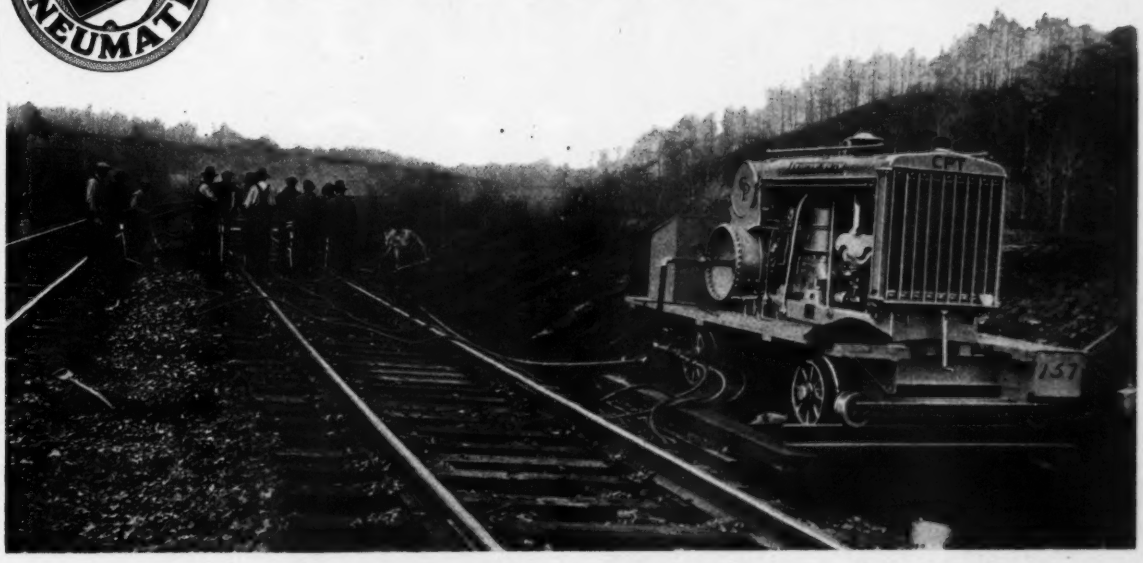
TRY COOVER BRACES WHERE



EVERY OTHER DEVICE FAILED

The Coover Railroad Track Brace Co. - Dayton, Ohio

SELF-PROPELLED COMPRESSOR and "STRAIGHT BACK" TIE TAMPERS



On The Job

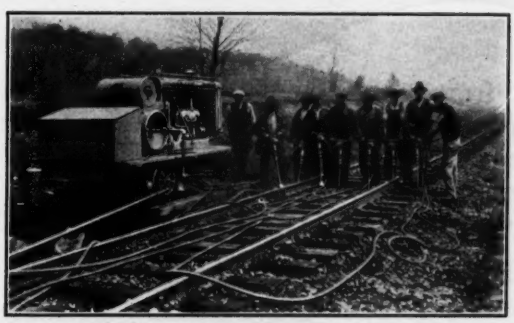
MANY railroads are using these units because of their convenience, speed and reliability. The standard CP Compressor is mounted on a truck frame carrying flanged wheels with Timken roller bearings, transverse shifting wheels and winch, air-operated lifting jacks, lifting bale and a roomy tool box. The gasoline engine that operates the compressor also propels the car at a speed of 12 to 18 miles per hour, depending upon its size. The compressor is furnished in sizes of 100, 160, 250 and 310 cu. ft. per minute displacement. The CP Tampers have several interesting features that are fully described in folder No. 1646. Details of the Self-Propelled Compressors are given in Bulletin No. 789.

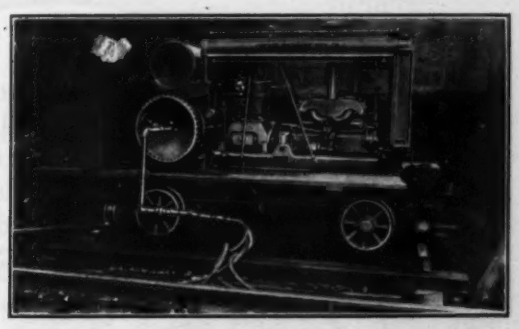
Chicago Pneumatic Tool Company

Railroad Department

6 East 44th Street, New York
1004 Mutual Bldg., Richmond, Va.
310 S. Michigan Ave., Chicago

J-293





CARNEGIE RAILS

& RAIL JOINTS

Control of manufacture from ore mine to finished product, plus unlimited facilities for correct manufacture, permit us to serve you promptly and efficiently. Let us quote on your next requirements.

CARNEGIE STEEL COMPANY

PITTSBURGH, PA.

There's always a job for this little Crane

It will load, unload and lay rail. It will handle boxes and skips in cleaning stone ballast; also frogs, switches, culvert pipe, etc., from cars to point of use. It is ideal for a large variety of small excavation work, using clamshell, dragline or orange-peel buckets within its capacity. It will load, unload and transfer cinders, crushed stone, gravel, sand, slag, concrete and other construction materials, etc.

HUNDREDS of maintenance and construction operations, now being performed by hand or by highly specialized machines, can be handled more advantageously and economically with the Buckeye *Light Utility* Crane.

Ruggedly built, it has ample strength for all normal lifting capacities, which vary from 7,000 lbs. at a 10′ radius with a 21′ 6″ boom to 1,800 lbs. at a 30′ radius with a 33′ boom.

Slow-speed, heavy-duty industrial motor furnishes plenty of power for ordinary requirements, with a dependable reserve for emergencies. All of this power can be used, for every working part is capable of standing the extra strains that construction machinery must take frequently.

Full-revolving, it works in any direction. Flanged wheel mounting permits operation directly from the track or from rails laid on flat cars. Alligator (crawler) traction is available for other service independent of track.

Mass production of one standardized model enables us to sell the *Utility* Crane for $4800 f. o. b. factory, equipped with steel cab and flanged wheels.

Because of its low price and the fact that it can be kept busy on some job or other throughout the year, this Buckeye offers greater working capacity per dollar of investment.

Write for complete construction and performance details

THE BUCKEYE TRACTION DITCHER COMPANY, FINDLAY, OHIO

There's a Buckeye Sales and Service Office near You

for over thirty years

Buckeye

Be careful—protect your cement

AVOID loss! Buy your cement in Bates Multi-Wall Paper Bags. The 5 tough, pliable walls of Bates Bags give the materials inside positive protection from moisture and rough handling. You can pile these bags anywhere and when they are opened they will deliver 100% of their contents to the mixer in perfect condition.

BATES VALVE BAG CORPORATION
35 East Wacker Drive, Chicago

BATES Multi-Wall PAPER BAGS

Bates Multi-Wall Paper Bags are made by the Bates Valve Bag Corporation in 9 modern plants throughout the country

AN

EXAMPLE

OF THE

ENTHUSIASTIC

ENDORSEMENT

WHICH THE

"I am now laying new 130# rail with Fair Rail Anti-Creepers. It certainly makes a big difference in the labor when one man can follow up the job and take care of the anchors, in stead of having to put six to twelve men on the work. It makes a particularly big difference to us right now because we are having to lay this heavy rail with a force of only 30 laborers."

FAIR
Rail Anti-Creeper

RECEIVES

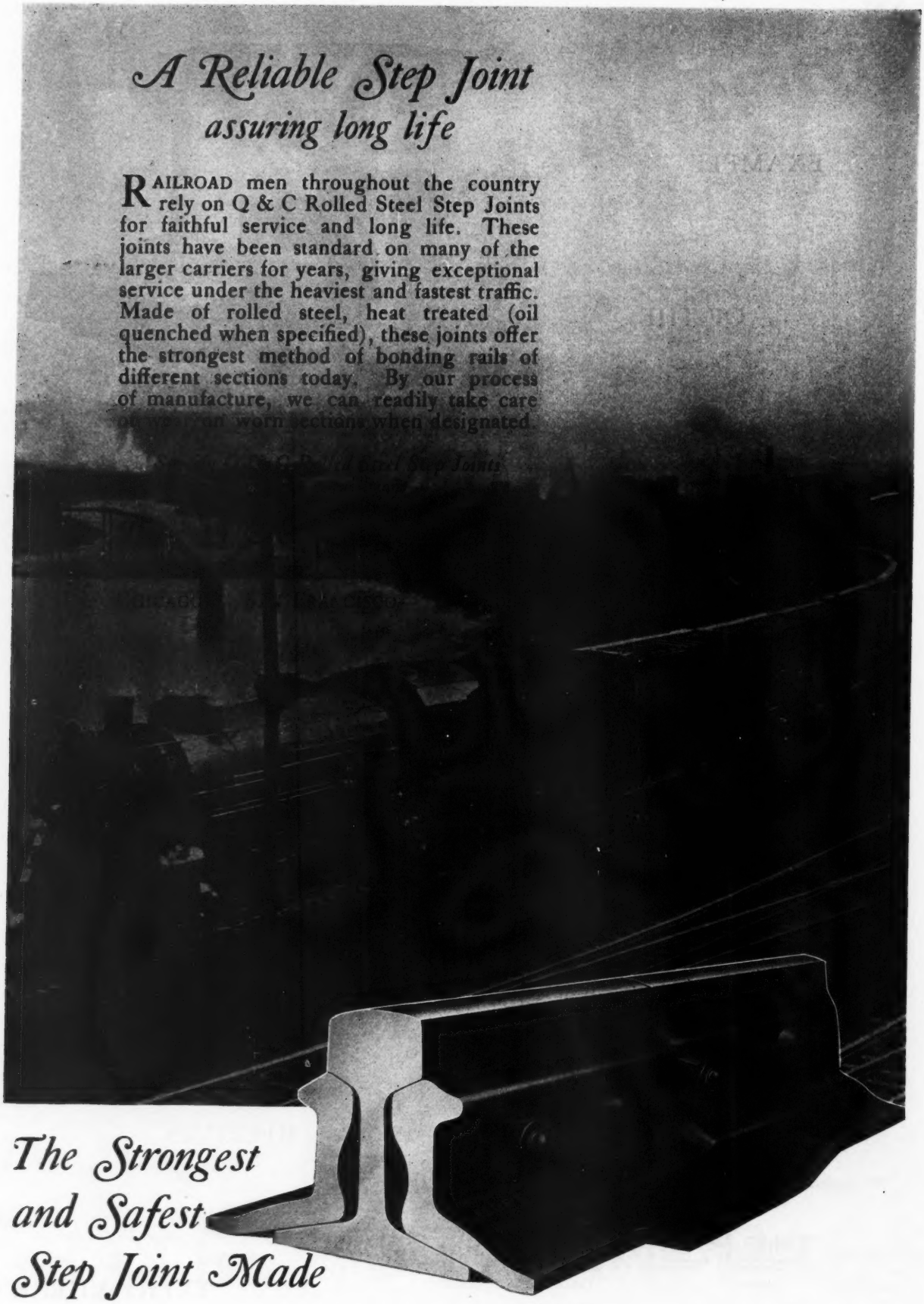
CHICAGO THE P. & M. CO. NEW YORK

MONTREAL LONDON PARIS CALCUTTA SYDNEY

EVERYWHERE

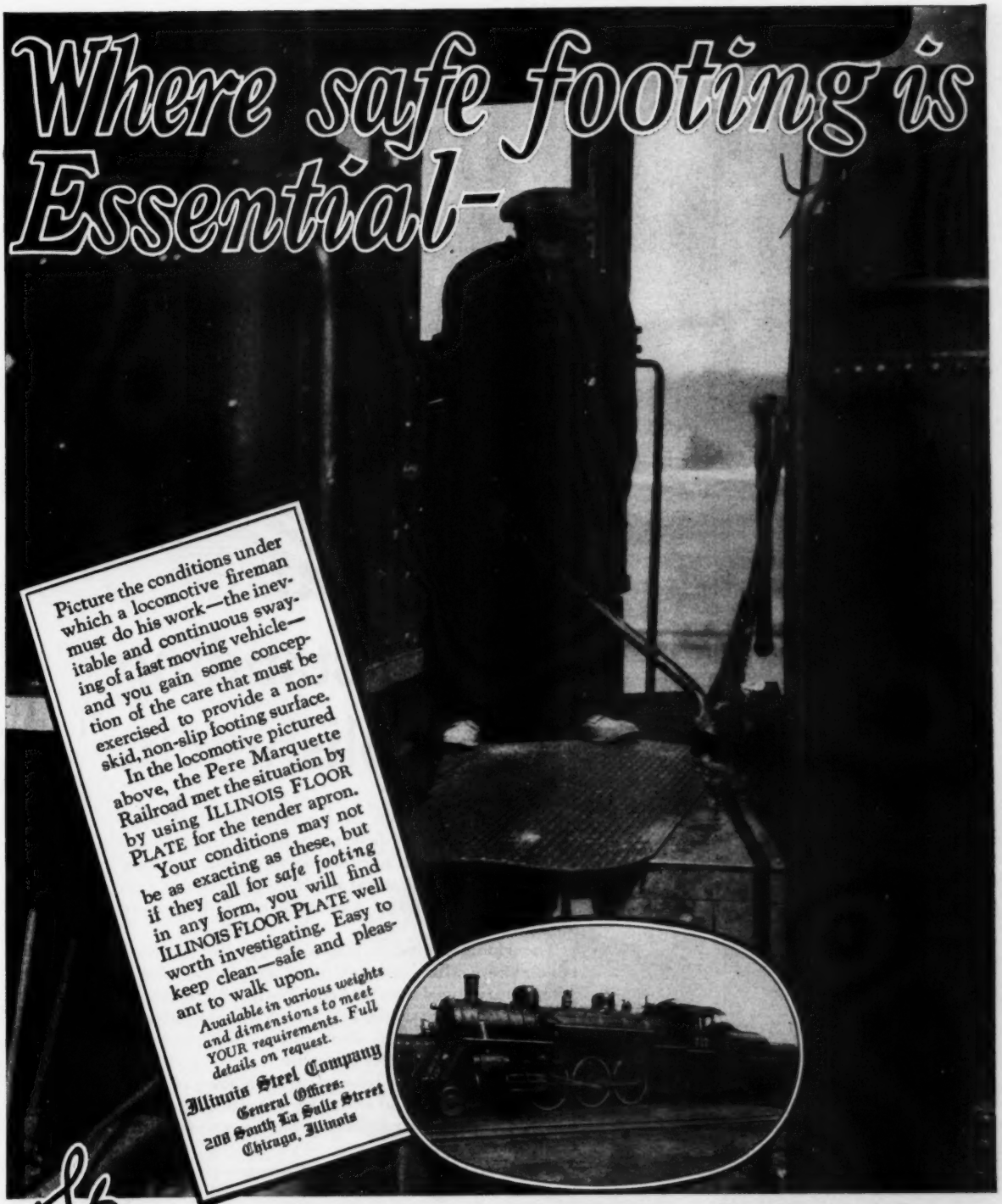
A Reliable Step Joint
assuring long life

RAILROAD men throughout the country rely on Q & C Rolled Steel Step Joints for faithful service and long life. These joints have been standard on many of the larger carriers for years, giving exceptional service under the heaviest and fastest traffic. Made of rolled steel, heat treated (oil quenched when specified), these joints offer the strongest method of bonding rails of different sections today. By our process of manufacture, we can readily take care of worn or worn sections when designated.



The Strongest and Safest Step Joint Made

Where safe footing is Essential—



Picture the conditions under which a locomotive fireman must do his work—the inevitable and continuous swaying of a fast moving vehicle—and you gain some conception of the care that must be exercised to provide a non-skid, non-slip footing surface.

In the locomotive pictured above, the Pere Marquette Railroad met the situation by using ILLINOIS FLOOR PLATE for the tender apron.

Your conditions may not be as exacting as these, but if they call for *safe footing* in any form, you will find ILLINOIS FLOOR PLATE well worth investigating. Easy to keep clean—safe and pleasant to walk upon.

Available in various weights and dimensions to meet YOUR requirements. Full details on request.

Illinois Steel Company
General Offices:
208 South La Salle Street
Chicago, Illinois

Specify ILLINOIS FLOOR PLATE

An outstanding accomplishment

IN March 1928, after five years of boring through the Rockies, the first train passed through the Moffat Tunnel in northwestern Colorado. It is the highest tunnel in the world and the longest in America, penetrating six miles of solid rock at an elevation of 9,000 feet.

The Moffat Tunnel furnishes the gateway to a veritable empire which is larger than all France. In this great undeveloped area are coal lands more extensive than those of Pennsylvania and West Virginia combined, enough oil to supply the whole country for a thousand years, and ten billion feet of timber.

This is a spectacular triumph of railroading. But the remarkable efficiency of every-day railroad service provides an even greater insurance for the growing prosperity of America.

The Oxweld Railroad Service Company is helping to maintain the high standards of modern railroading by supplying the oxwelding needs of most of the important railroads of the country. It is a railroad type of organization, equipped by years of experience to cooperate with any railroad.

OXWELD RAILROAD SERVICE

THE OXWELD RAILROAD SERVICE COMPANY

Unit of Union Carbide UCC *and Carbon Corporation*

New York City: Carbide and Carbon Building
Chicago: Railway Exchange

AFTER 10 YEARS

on a 9½° Curve Under Heavy Traffic *Protected by*

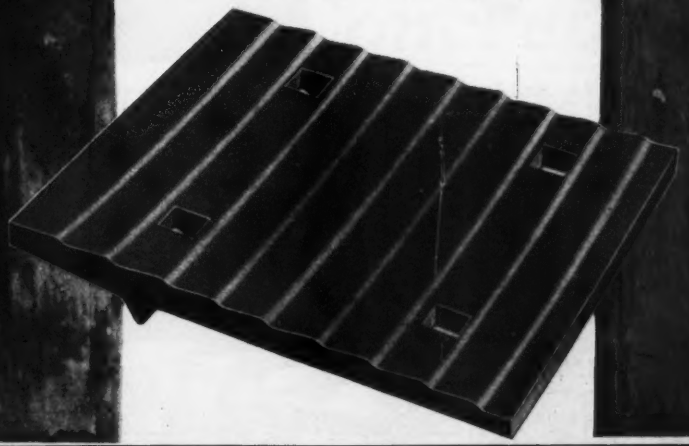
LUNDIE TIE PLATES

ATTENTION is directed to the perfect seating of the tie plates on the ties, total absence of plate movement and, further, the absolute elimination of any mechanical wear.

Compare these photographs and service record with similar exhibits shown in A. R. E. A. Bulletin No. 306, June, 1928, "Mechanical Wear of Ties."

The Lundie Tie Plate is not merely a tie plate but a proven economic device, particularly from the standpoint of cross tie conservation. It absolutely *protects* the tie against mechanical wear. The proof lies in the facts.

The Lundie Engineering Corporation
285 Madison Avenue, New York
166 West Jackson Boulevard, Chicago

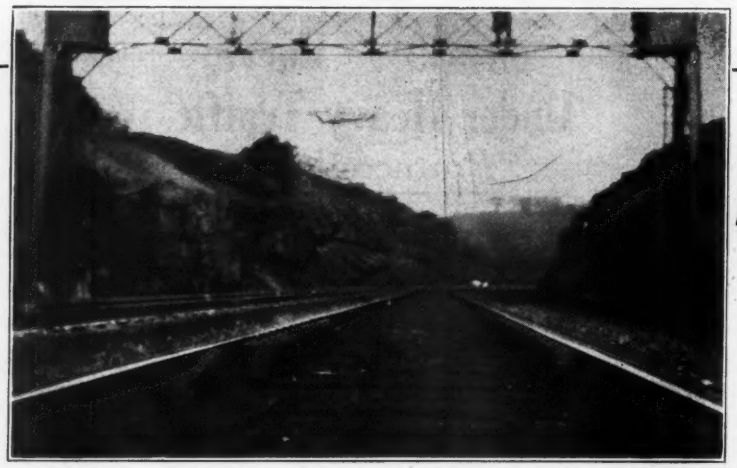


LUNDIE TIE PLATE

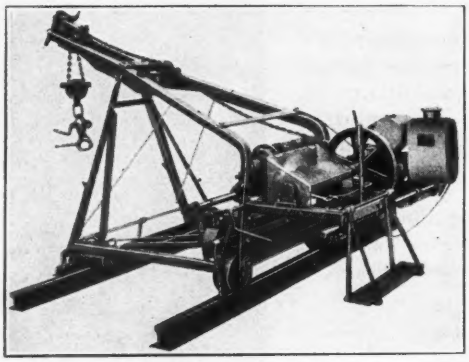
The Derrick Automatic Rail and Flange Lubricator

(Improved Design)

SAVES RAILS

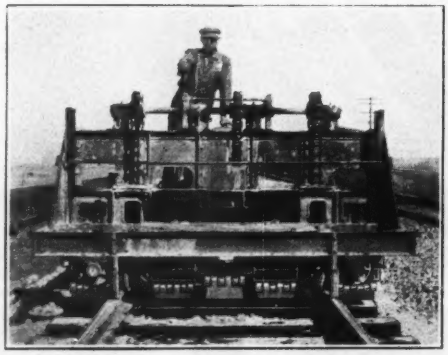


SAVES WHEELS

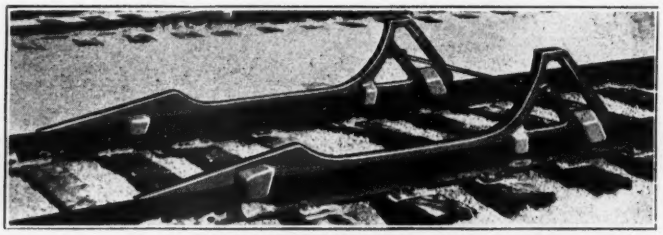


Power Operated Three-Man Rail Layer
Also furnished as a hand operated type

Mack Reversible Switch Point Protector



The Jackson Power Track Ballaster



FRICTION Car Stops

MAINTENANCE EQUIPMENT COMPANY

Railway Exchange Bldg. Chicago, Ill.

New York Cleveland San Francisco St. Louis

State Highway Dept. Maintenance Force laying Kyrock wearing surface on Yellowstone Trail, (U. S. Route 20) at Harbor Creek, Pa., Sept., 1928. Marginal curbs are not necessary with Kyrock. The inset shows views of unprotected Kyrock edge flush with concrete —after 5 years' service on the Latrobe-Kingston Road, Westmoreland Co., Pa.

A Kyrock Top Saves Concrete Roads

The Yellowstone Trail—Cleveland-Buffalo road, (U. S. Route 20) constructed of cement concrete in 1920, was disintegrating under traffic. Patching was no longer effective and maintenance cost excessive. A wearing surface of Kyrock stopped the maintenance cost and restored this road to service, with a smooth, resilient, NON-SKID driving surface. No marginal curbs or extra shoulder material necessary—no interruption to traffic. *Investigate Kyrock.*

The Kyrock top protects the old base and prevents further disintegration. Surfacing with Kyrock may be done on half the road at a time without interruption to traffic. Kyrock is laid cold. It is resilient, non-reflecting, NON-SKID. On concrete it reduces vibration 75%. *Investigate Kyrock.*

KENTUCKY ROCK ASPHALT CO., *Incorporated*, LOUISVILLE, KENTUCKY

Kyrock

The Uniform Pavement

KENTUCKY ROCK Kyrock ASPHALT

ANNOUNCEMENT!

Effective November 1st, the Louisville Frog and Switch Company has changed its name to the Louisville Frog Switch and Signal Company. This change in name was due to combining the operations and plants with its subsidiary, the Southern Signal Corporation, which heretofore has been operated under the same management.

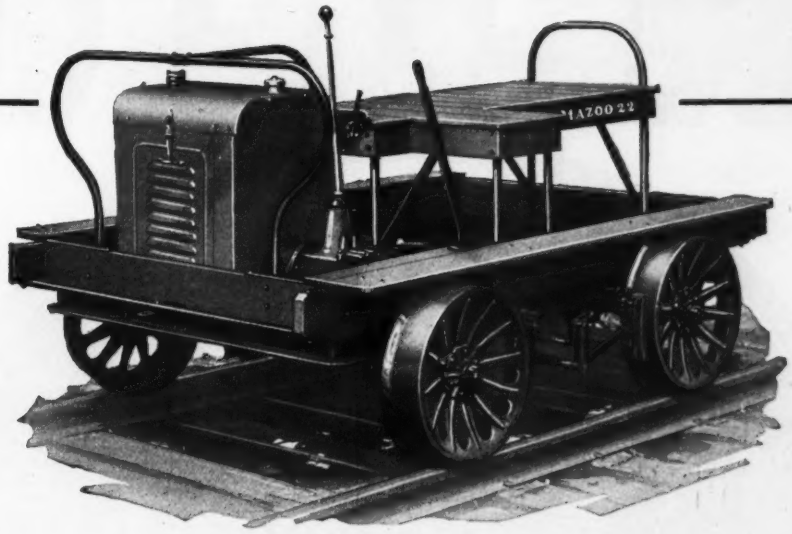
Louisville Frog Switch & Signal Company

Louisville **Kentucky**

DISTRICT MANAGERS

C. W. Stevens	Mutual Bldg.	Richmond, Va.
T. F. Carlin	631 Penn. Ave. N. W.	Washington, D. C.
J. R. Hayward	512 Liberty Natl. Bank	Roanoke, Va.
E. A. Mann	1603 Monadnock Bldg.	Chicago, Ill.
C. H. Quinn	681 Market St.	San Francisco, Calif.
L. M. Hartzell	Union Trust Bldg.	Cincinnati, Ohio
L. R. Payton	1944 Rwy. Exchange Bldg.	St. Louis, Mo.
T. L. Mount	136 Liberty St.	New York, N. Y.

IMPROVED!



KALAMAZOO
one-man inspection car

This new Kalamazoo motor car No. 216L supersedes the Kalamazoo No. 16L motor car, being more simple in construction and developing more power. It is equipped with a water cooled engine, flywheel magneto, and embodies many other improvements.

It insures safety and may be handled by one man with perfect ease. Ask for descriptive bulletin.

"Kalamazoo Means Service to You"

KALAMAZOO RAILWAY SUPPLY CO.

Established 1883

Kalamazoo **Michigan**

New York St. Louis New Orleans Spokane Portland, Ore. Chicago St. Paul Denver Seattle London
Johannesburg Winnipeg San Francisco Havana Mexico City Vancouver

KREOLITE

SOLID UPLAND MOUNTAIN OAK R. R. CROSS AND SWITCH TIES

The favorable location of our several Plants enables us to purchase solid Upland Mountain Oak to advantage.

The life of treated timber depends upon the character of the preservative used. **We distill our own Creosote Oil.** By so doing it is possible for us to insure to the purchaser a uniform pure product of any grade desired.

Enormous stocks of Cross Ties, Switch Ties, Structural Timbers and Piling, in all sizes, in Solid Oak or Pine, properly sticked and air seasoned before treatment, available for prompt shipment from Toledo, Ohio, or our Midland Creosoting Company plant, Granite City, Ill. (East St. Louis).

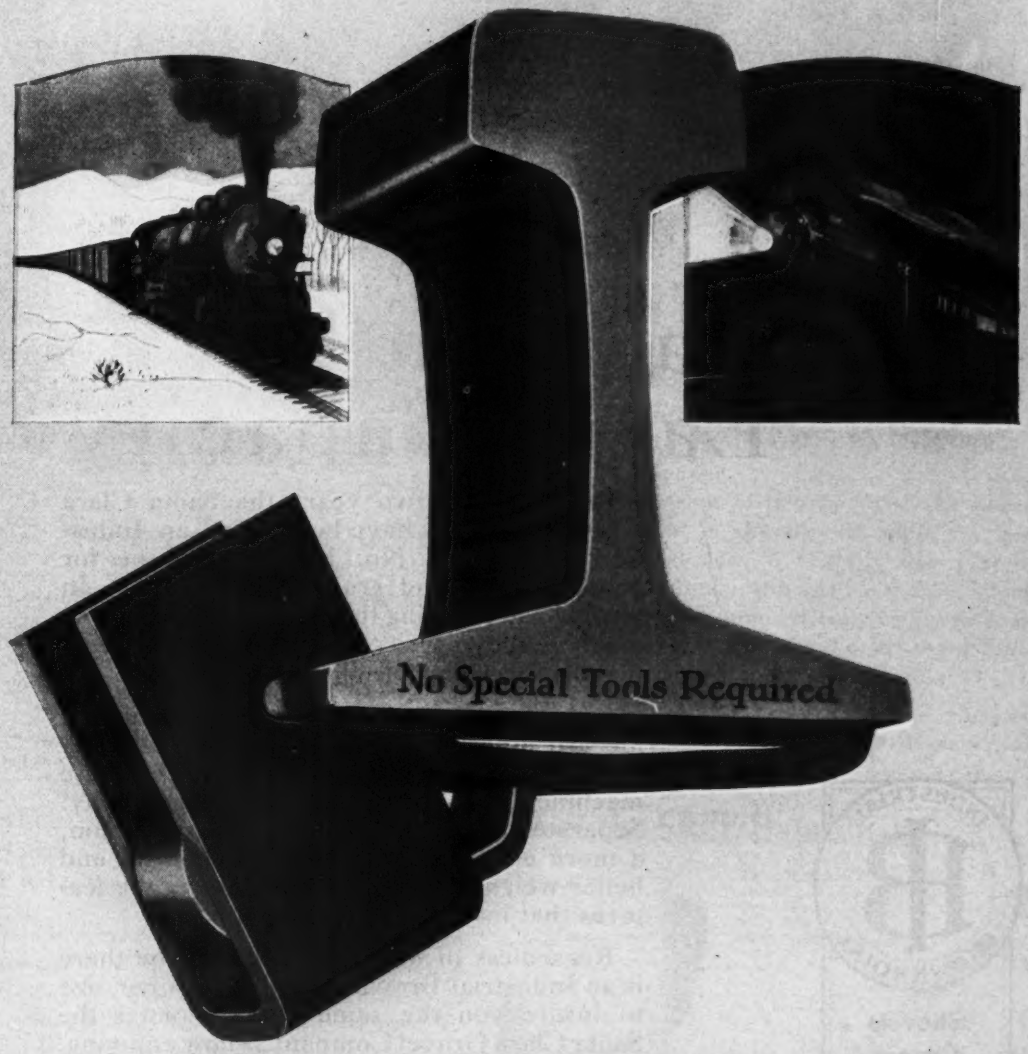
THE JENNISON-WRIGHT COMPANY, TOLEDO, OHIO

Branches in All Large Cities

R.R. TIES

"STEAD"
TRUE TEMPER RAIL ANCHOR

Day or Night, Summer or Winter, Single or Double Track,
STEAD ANCHORS always hold the rails safely.
Initial and Application Costs Low.



The American Fork & Hoe Company

General Offices: Cleveland, O. *Factory:* North Girard, Pa.

District Offices
Whitehall Bldg., New York, N. Y. Railway Exchange Bldg., Chicago, Ill.
Representatives at
Boston, Detroit, Minneapolis, St. Louis and San Francisco

Foreign Representatives
Wonham, Inc., 44 Whitehall St., New York, N. Y.; and 68-72 Windsor House, Victoria St., London, S.W.1

"We Marvel at Its Large Capacity"

For the past two years the Santa Clara Gravel Company have been using an Industrial Brownhoist No. 1 crawler crane for handling sand and gravel at their pit. In writing us regarding the performance of their machine they say: "We marvel at its exceptionally large capacity for so small a rig."

Big output, economy of operation, and long life are inherent advantages of every Industrial Brownhoist. Look over one of these machines carefully and you will soon see why. Separate clutches for each operating function, a more efficient boom hoist mechanism and better weight distribution are among the features that insure better service.

Regardless of what your job may be there is an Industrial Brownhoist of the proper size to insure you the same satisfaction as the Santa Clara Gravel Company is now enjoying. It will pay you to have our catalogs on file.

INDUSTRIAL BROWNHOIST

Shovels
Cranes
Draglines
Trench Hoes
½, ¾, 1, 1⅛, 1¼ Yard Capacity

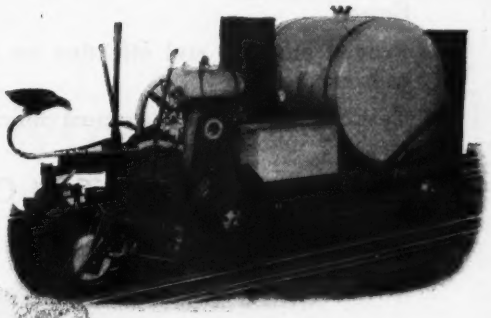
Industrial Brownhoist Corporation
General Offices: Cleveland, Ohio
District Offices: New York, Philadelphia, Pittsburgh, Detroit, Chicago, San Francisco, New Orleans.

INDUSTRIAL BROWNHOIST

SAM, the Section Boss Says—

"Why Buy Five Tools —when ONE will do?"

"Why in the devil does the Old Man buy machines to burn and disc and mow and sprinkle poison—when ONE good, wide-burning weed burner gets all the weeds on the roadbed and in the ditches, too?"



Woolery Rail-Joint Oiler

Corroding of bolts and rail-joints is now preventable at so much lower cost than ever before, that it is extravagance not to protect your track joints.

A single-unit, one-man drive machine that oils rail-joints better than by hand, at a fraction of the cost. Reports show a cost of $1.00 to $2.00 per mile—instead of the $5.00 to $9.00 cost per mile reported for hand oiling.

The unit machine shown above has oil capacity for oiling about 50 miles of rail-joints. Extra oil capacity may be provided by a trailer tank-car similar to the car used for the Woolery Weed Burner.

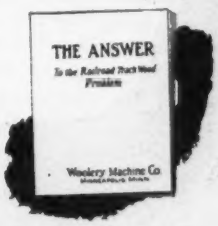
Woolery
CONTROL-TYPE Weed Burner

Burns Weeds Even in Ditches

Whether you want to destroy weeds on ballast only, or weeds in ditches—or both, this new Woolery Burner does it. Side burners may be swung out to burn an extra swath—making a total width of 25 feet or more, destroying weeds completely even over rough ground or among obstructions where other machinery cannot work.

Costs $3.00 to $6.00 per mile—the cheapest known method—gets all the weeds—saves section crew time for constructive maintenance work.

Get the FREE Data Book



These facts and figures should be in your file for reference — they will save money for your road. Sent free —no obligation.

Woolery Machine Co.
2913 Como Ave. S. E. Minneapolis, Minn.

TEAR OFF THIS MEMO COUPON NOW

Woolery Machine Co., 2913 Como Ave. S.E., Minneapolis, Minn.

Please send me your free Data Book, "The Answer to the Railroad Track Weed Problem."

Name.....

Road.....

Position..... REM 12-28

WOODINGS RAIL ANCHOR

MADE in one piece of high carbon heat treated steel.

Easily applied by one man.

Grips rail with enormous pressure.

Extra large loop gives good bearing.

Gives strong and positive anchorage.

Holds most difficult track from creeping.

Can be removed and reapplied many times.

Proved efficient and effective on 21 railroads.

Test this anchor on your most difficult track.

Woodings Forge & Tool Co.
Works and General Sales Office
Verona, Pa.

The oldest frame house in the oldest American settlement. Built in St. Augustine, Florida, more than 250 years ago. The original cypress, unpainted, is weathertight today.

A wood that fights its own battles —whether you paint it or not

EVEN without the protection of paint, heart grade Tidewater Red Cypress defeats weather at every turn. For better appearance and even greater durability, paint is, of course, desirable. But artificial protection is not absolutely essential.

When you order this Wood Eternal, be sure to specify "Heart Grade Tidewater Red Cypress"—for outstanding durability is found only in the "coastal type" red cypress that grows near the Gulf and South Atlantic Seaboard.

Consider the saving this lumber effects in all forms of construction, where durability and structural strength are of prime importance. Consider its economy for all construction where upkeep and depreciation must be shaved down to the last dollar.

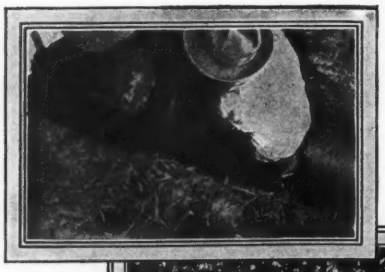
Tidewater Red Cypress is especially adapted for:
Passenger station construction
Freight sheds and warehouses
Platform construction
Conduits for signalling systems
Water tanks—box cars—cattle cars—refrigerator cars
Yard fencing

In short, any use where long life and absolute freedom from repairs are essential.

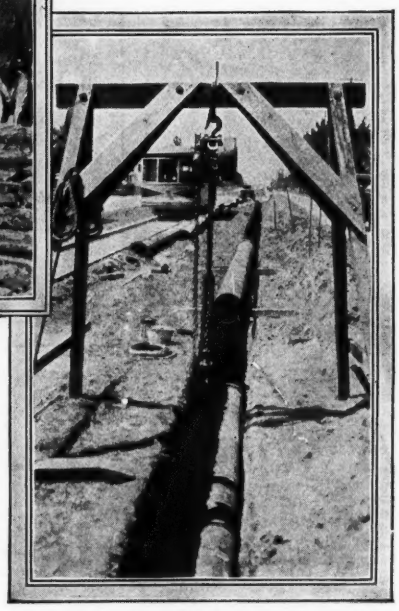
Complete information on this long-lived wood will be sent free of charge in the booklet, "Money Saved for Builders," and other literature on cypress. Send for it today. Southern Cypress Manufacturers Association, Dept. RE-12, Barnett Bldg., Jacksonville, Fla.

Specify TIDEWATER RED CYPRESS

THE WOOD ETERNAL



New method reduces pipe laying costs



–Pontiac success widely observed

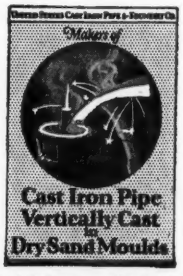
ENGINEERS and officials of leading mid-western gas companies gathered at Pontiac, Michigan, recently to inspect the laying of a new type main.

Two thousand feet of 12″ multiple length*deLavaud cast iron pipe with Anthony joints was laid in record time despite unusual difficulties in grade crossings and at street intersections.

So much interest was shown in the success and economy of this latest type of cast iron pipe for high-pressure gas and water lines that a brief engineer's report of the work has been prepared. A limited number of copies of this report is available to anyone interested in this most recent development in underground pipe lines.

Photographs and data by courtesy of Consumers Power Co.

Upper left picture shows the simplicity of connecting the Anthony Joint. No special tools or skill required. Center photograph illustrates the ease of handling 24 ft. lengths of deLavaud pipe. Right hand illustration shows the chain hoist used to lower pipe into trench.



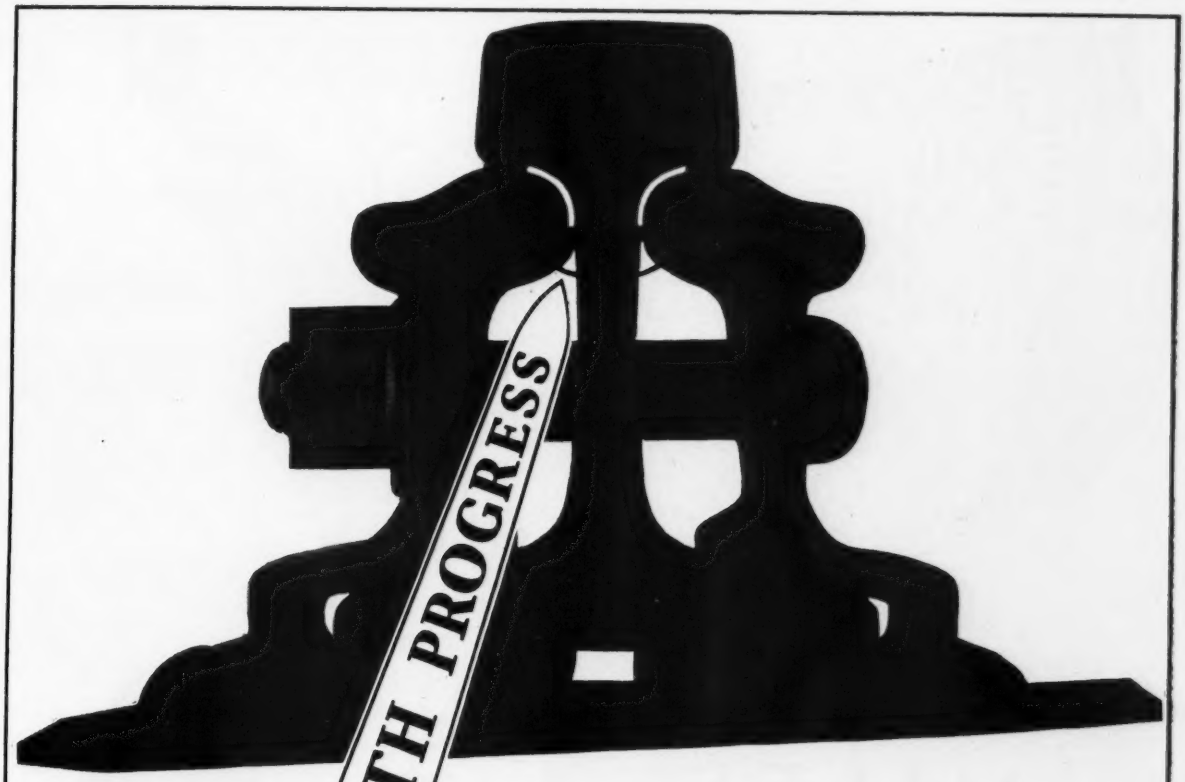
*Note: Multiple length deLavaud pipe comes in 24 ft. lengths consisting of two standard 12 ft. lengths bronze welded at the plant under ideal conditions, and shop-tested.

United States Cast Iron Pipe and Foundry Company

General Offices:
Burlington, New Jersey

Philadelphia: 1421 Chestnut St.
Chicago: 122 So. Michigan Blvd.
Birmingham: 1st Ave. & 20th St.
Buffalo: 957 East Ferry Street
Cleveland: 1150 East 26th Street
New York: 71 Broadway

San Francisco: 3rd & Market Sts.
Pittsburgh: 6th & Smithfield Sts.
Dallas: Akard & Commerce Sts.
Kansas City: 13th & Locust Sts.
Minneapolis: 6th Street & Hennepin Avenue



KEEPING PACE WITH PROGRESS

ON
NEW OR OLD
RAIL

THOSE HEADFREE BEARING AREAS
NEVER VARY IN EXTENT
— NEVER GREATER — NEVER LESS —

STRONG LIFE LINES
THAT GUARANTEE MUCH LONGER LIFE
BOTH FOR RAILS AND SPLICE BARS
THAN CAN BE GOTTEN
WITH ANY OTHER
TYPE OF
BARS

THE RAIL JOINT COMPANY
165 Broadway — New York City
OR ANY ONE OF OUR DISTRICT OFFICES

—MILES!

Miles—measured in units of hundreds of thousands—serve only to emphasize the special fitness of Timken tapered construction, Timken *POSITIVELY ALIGNED ROLLS* and Timken electric steel to survive in railroad service.

Timken Bearings have demonstrated their ability to lower starting resistance, to fight down friction, to lessen lubrication and maintenance requirements.

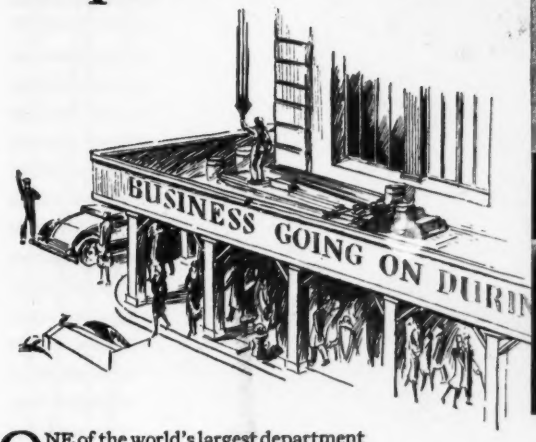
Now, Timken Bearings are showing with striking clearness how they can withstand shock, thrust, weight and speed, and pile up the resulting benefits mile after mile.

THE TIMKEN ROLLER BEARING CO.
C A N T O N , O H I O

TIMKEN *Tapered Roller* BEARINGS

A LUMBER PROBLEM in a Department Store?

certainly . . . and a Lumber Consultant helped solve it!



ONE of the world's largest department stores is a big lumber user—warehouse repairs . . . rolling stock to keep in perfect condition . . . show cases and display tables must look right . . . odd-job repairs about the store . . . crating of merchandise—surprising the amount of lumber consumed and the wide variety of species used. Even more surprising that their annual lumber bill runs high into five figures!

But they were not equipped to specify correctly . . . they didn't know where a lower grade would answer the purpose . . . they didn't know lumber sources or prices. What to do? . . . where to buy? . . . who would advise them?

Then they thought of the National Lumber Consultants Service. An expert qualified to study their requirements called. Needs were analyzed . . . storage facilities checked . . . costs compared. The Lumber Consultant told them what grades to buy . . . the sources of supply . . . how to store and use their lumber.

Cost? There is no cost for the Lumber Consultants Service.

You, Too, Can Use This Service

One hundred Lumber Consultants, strategically located throughout the country bring to *your* problem the collective experience gained by solving the problems of manufacturers, wood user, architect, engineer, builder. They come to your office backed by the resources and accumulated knowledge of the National Lumber Manufacturers Association and its 17 Affiliated Associations.

Wherever lumber or alternative materials enter into your business their advice and counsel are valuable. Their purpose is to help wood users get the utmost value from this product. No matter how small or how large your lumber problem, Lumber Consultants can help you. Their services cost you nothing.

How to Arrange for a Consultant to Call

Telephone or write the nearest association office stating your specific problem: National Lumber Manufacturers Association, Washington, D. C., or New York, Atlanta, Pittsburgh, Boston, Chicago, Indianapolis, Dallas, Memphis, San Francisco, Portland, Ore., Kansas City, Minneapolis.

CERTIFIED BY CENTURIES
..WOOD..
Use it—Nature renews it

NLMA

MAIL COUPON FOR
Interesting Consultant Leaflet

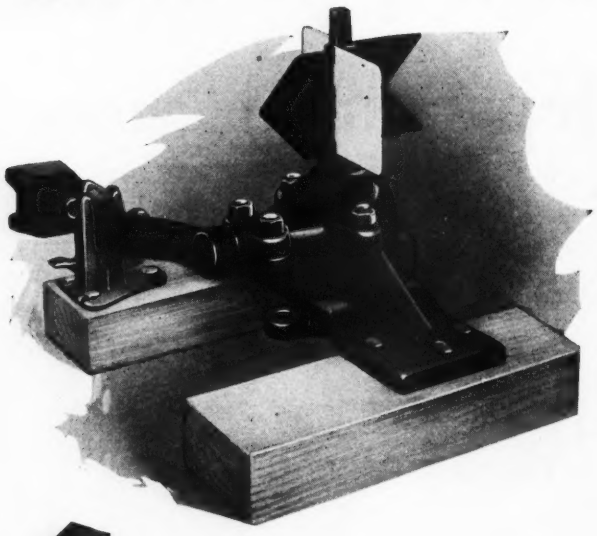
National Lumber Manufacturers Association
Transportation Bldg., Washington, D. C.
Dept. 4301
Gentlemen: Please send me a Free copy of "100 Lumber Consultants at Your Service."
Name.....
Company.....
Street.....
City.....State.....

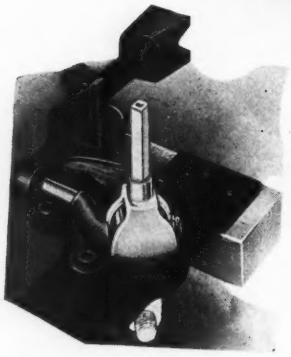
NATIONAL LUMBER MANUFACTURERS ASSOCIATION

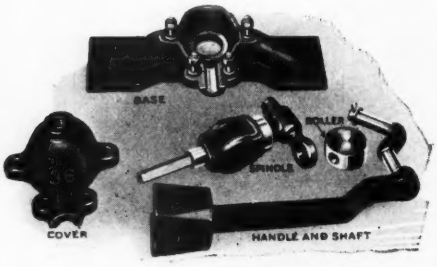
WASHINGTON, D. C.

"American Standard Lumber From America's Best Mills"

RACOR







The Racor XL-36 Overcomes Habitual Rigid Switch Stand Trouble

THE Racor XL-36 Parallel Throw Gearless Switch Stand has been designed to eliminate gears and the undesirable features and parts which cause practically all the trouble with ordinary types of low rigid switch stands; namely, excessive wear of parts and lost motion. With this in mind the XL-36 is built with extra large wearing surfaces; has a smaller number of working parts than any other stand on the market today, and is being termed the "Perfect 36."

The mechanism contained in the housing consists of only three members, the Spindle, the Shaft with its operating handle, and the Rotating Disc or Roller, all of rolled or forged heat treated steel.

The operating parts are all machined to accurate fit with each other and the housing, thereby reducing lost motion to a minimum. With bearing surfaces amply large throughout, wear becomes almost negligible in the ordinary sense as experienced in similar installations of old style rigid stands.

RAMAPO AJAX CORPORATION

Sales Offices - 30 CHURCH ST., NEW YORK
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Railway Engineering and Maintenance

Volume 24 December, 1928 No. 12

The Interest Charge Goes On

THE MANAGEMENTS of the industries in this country are constantly spending money for additions to their plants and equipment. Some of these additions are necessary to take care of increased business, but in many cases, they are provided for the purpose of reducing operating expenses. The money spent for such purposes costs money;—that is, it must pay a return, either in dividends on stock issued or in interest on notes or bonds. Therefore, in making studies of such improvements, it is necessary to know how much the improvements will cost, what the annual interest charges will be, and how much will be saved by the installation of the new facilities.

Such economies are necessarily calculated in terms of the labor saved, and as labor is figured on an hourly basis, the value of a new machine or plant must be considered in the same way. Therefore, the total saving that can be effected depends directly on the number of hours of useful work which the new facility can do in a year.

This same process of reasoning must be applied to any equipment bought to reduce the labor required for maintenance of way work, and most purchases are undoubtedly made on such considerations. But do the men who have the use of such equipment always think of it in the same way? The interest on a unit of work equipment continues to accrue, whether it is in use or not, but the savings are effected only when it is actually at work. A power tamper, a spreader or a crane is of value only when it is earning a return on the investment made in it.

Don't Forget the Section Gangs

ONE OF THE outstanding developments in maintenance of way work during the last two or three years has been the study given to the organization and equipment of floating gangs engaged in such major operations as ballasting and rail laying. Where large gangs are employed, as in these operations, it is highly important that they be so directed as to produce the maximum results.

Yet in the study that is given such operations one should not lose sight of the fact that, after all, the larger part of the money that goes for track maintenance is spent by the section gangs. While these gangs are smaller, they are so much more numerous as to outweigh the larger gangs in payroll expenditures. It is in the direction of these expenditures that more attention should, therefore, be paid. It is here also that the greatest opportunity for economy exists today. In part, this is due to the use of unsystematic methods in the selection of men to direct the work of these gangs. To at least an equal extent it is due also to the lax methods of training these men in their duties, both prior to and following their appointment as foremen. It is also a result in part of the constant interruptions of their work by instructions from a wide variety of sources to do one task after another promptly, many of which fall outside the functions of ordinary track maintenance.

What is needed is a fuller appreciation of the magnitude of the expenditures made by these forces and the resulting importance of getting the maximum amount of constructive work for these expenditures. Such a realization must start within the department itself. When division engineers, roadmasters and supervisors come to realize the possibilities of organization here in the same degree that they are now impressed, on a number of roads, with the necessity for the proper organization of their rail laying and ballasting gangs, higher standards of production will be reflected in their section gangs.

The Transverse Fissure Can Now Be Located

SINCE its identification as a distinct type of rail failure in 1911, the internal transverse fissure has come to be more greatly feared by track men than any other type of failure, by reason of the complete lack of warning of its presence. It has been responsible for the most serious accidents chargeable to defects in roadway in recent years. Its prevalence has been widespread, few roads being spared. It has become a constant threat. Its cure is still challenging the ability of many metallurgists, and until now its presence was undiscoverable.

With the development of a machine to detect this form of defect in rails as they lie in track, promise of release from the anxiety which it has caused is now offered. As described on page 521, this device has demonstrated, to the satisfaction of the Rail committee of the A. R. E. A., its ability to locate such defects before failure occurs. A means is now available, therefore, to eliminate this menace.

Primary interest in the work of this machine is, of course, reflected in the number of fissures found. Their frequency has long been a matter of conjecture. Some have expected to find them in a relatively large percentage of the rails in service, while others have maintained that they are few in number. While the two machines which have been built to date have not been operated over enough track to yield any conclusive information as to what is to be expected, it can be reported that on the first 166 miles of track checked, the number of rails in which fissures were indicated was less than 0.06 per cent of those subjected to test. However, on 150 miles of an-

other road, the number of fissures found exceeded one per mile, several of which were sufficiently large to warrant the removal of the rails from the track immediately. It is significant that fissures have been found on all of the roads on which the car has been operated to date.

Although these cars have been in operation less than a month, some interesting effects are already being observed. On the one hand, the anxiety that has prevailed in some quarters is giving way to a degree of complacency that would appear to be unwarranted, so long as a single fissure remains in track. This is being evidenced by a relaxation in the demand for the use of the car on some roads.

Among other interesting angles of the question is that regarding the action that should be taken with respect to the remaining rails in a heat, after a specified number, such as three, have been removed because of fissures. On a number of roads it is the practice to remove all such rails from main passenger tracks, and this practice is required by the regulating authorities in some states. With the fissure-detecting machine available, however, it should now be possible to determine with some certainty whether these remaining rails in a heat really contain fissures. If they are shown to be free of this defect there should be no reason for removing them. By such a check it is felt by some that the loss of rails from this cause will be greatly reduced, while at the same time those rails which do contain fissures will be detected and removed.

All of the above effects are as yet largely conjectural. The important feature at present is the fact that a means of protection against the hazard of the transverse fissure appears to be at hand. The American Railway Engineering Association, the inventor of the machine, and those railway men who have persevered in the development of this machine are entitled to much credit for the service which they have rendered the transportation industry.

Machinery and Production

DR. JULIUS KLEIN, director of the United States Bureau of Foreign and Domestic Commerce, is authority for the statement that the investment in machinery per capita in the United States in 1925 was $23.66, as compared with $10.19 in Great Britain, $8.62 in Germany, $3.42 in France and $1.02 in Russia. What the effect of this has been in the relative efficiency of industries in these countries is indicated by the statistics of a single industry, that of machinery manufacture, where we find that the money value of the output per employee during 1925 was $5,192 in the United States, $1,527 in Germany, $1,459 in France and $1,432 in Great Britain. In other words, by the greater use of machinery to reduce labor in this country the output per worker is more than three times that of the leading European countries, and wages are correspondingly greater.

While these statistics refer particularly to the machinery building industry, they are indicative of the transition that is going on in the railway industry. It is generally recognized that, particularly in the transportation department, the output per worker has increased greatly as a result of the purchase of new and larger locomotives, stronger cars, and of those facilities that promote the more intensive use of this equipment. Yet in many departments, as in maintenance of way work, the use of mechanical equipment is still in its infancy. It is true that many devices have been introduced of late years. It is true also that they are being adopted on an increasing number of roads. However, the progress that has been made to date is only a fraction of that possible when all of the various meritorious devices are universally applied.

One condition in railway service that greatly retards the use of such equipment is the lack of accurate, comparable cost data. This results in a large measure from the complexity and diversity of the tasks involved in the operation of a railway or even in the maintenance of the roadway. If the energies of a road were confined, for instance, to the tamping of ties and the earnings depended solely on the efficiency with which this operation was done, it is self-evident that hand labor would be quickly eliminated. It would disappear, likewise, in rail laying and many other similar operations. It is axiomatic that that road will be most efficiently operated whose individual operations are conducted most economically. It is a function of the successful railway management to break its composite operations into the separate tasks and then to see that each is done most efficiently. This is a major problem of supervisory maintenance officers. It has not yet received the attention that its importance warrants on the average road.

Is a Permanent Force Practical?

IT IS recognized as a fundamental principle in industry that continuity of employment is essential to efficiency and that a large labor turnover is destructive of production. As a result, a wide variety of measures have been devised by various roads to make employment attractive and to hold men in service. Yet in the face of this experience, the railways are now engaged in laying off more than 150,000 of their men in the maintenance of way department, or a third of the total force in this branch of the service. Furthermore, they have been doing this every fall from time immemorial. The magnitude of such a drain of the efficiency of a major department is too great to be ignored any longer. It challenges the courage and initiative of railway managements, and particularly of officers of the maintenance of way department whose operations are most directly affected.

That the problem is not without solution can be demonstrated by the experience of several roads. On the Delaware & Hudson, for example, it has been found possible to maintain a practically uniform force for several years, by transferring to the winter such work as can readily be done in that season. In addition, the working day is shortened in the winter and extended in the summer, this measure alone effecting a reduction of more than 25 per cent in the hours worked without the necessity of laying off a single man. By such means it is possible at all times to have a force of experienced employees eager to hold their jobs because of their permanence, with all of the other advantages that such continuity of employment involves.

To many railway men a permanent maintenance force seems visionary. They do not investigate its possibilities because they are convinced in their own minds that it will not work—on their own roads at least. As a result this drain continues year after year.

The principal objection to winter work is, of course, the difficulty of carrying it on in adverse

weather. This at once raises the question of the extent to which such weather is encountered. We are prone to think of winter as one succession of blizzards, for it is these storms that stand out in our memory. Yet the experience of those roads which have continued to operate through this season has shown that such weather is the exception rather than the rule, just as the downpour of rain and periods of excessive heat are limited in the summer. To satisfy themselves on this point it would be well for those who contend that winter work on other than a minimum scale is impractical, to observe the weather this winter, noting daily from December 1 to March 15 next, whether work could be continued without serious handicap on their respective districts. Such a record, and only such a record, will afford a basis for an accurate decision on this question. It is the least that an efficient maintenance of way officer, alert to improve his practices, can do.

As to Admixtures in Concrete

FOUR OR five years ago, anyone who discussed the use of admixtures in concrete with a representative of a cement manufacturer, received little encouragement. He was probably told that nothing would be gained by the introduction of admixtures that could not be accomplished by the expenditure of the same amount of money for additional portland cement. Such statements were the more convincing because some of the admixtures were being exploited under auspices that surrounded them with an air of secrecy. The idea of a mysterious compound, which was alleged to produce remarkable improvements in the quality of the concrete in some equally mysterious manner, was entertained with a great deal of skepticism by men with technical training, and it was only natural that they should place all admixtures in the same category.

This attitude has been subjected to a marked change. Of particular influence to this end, was the introduction of the high alumina cements with which it is possible to produce concretes of high early strength, a characteristic of great advantage in railway work under a variety of circumstances. As a consequence, these new cements gained an enviable popularity in an exceedingly short time.

It is obvious that this situation could not be ignored by the manufacturers of standard portland cement and it was not long before they took steps to point out that portland cement concretes proportioned for low water-cement ratios would develop much greater strength in a few days' time, than concrete of the conventional proportions. Such concrete would not have as great a strength in 24 hours as a concrete made with high alumina cements, but it would not cost as much, in spite of the use of an exceedingly rich mix, owing to the much greater cost of special cements.

However, the efforts to meet the new competition did not stop there. Scientific investigations of the effect of admixtures have not only resulted in more definite knowledge of their properties, but have also convinced the portland cement manufacturers that some of them may be employed to their own advantage. So, while the portland cement industry has by no means ceased its efforts to demonstrate the economies in construction to be gained by the use of concrete of high strength, that is, high in their content of portland cement, certain of the companies are now calling specific attention to the high early strengths that may be secured in portland cement concretes by the addition of certain admixtures.

This change in attitude on the part of the portland cement industry, together with a growing knowledge of the effects of admixtures and their specific limitations, have done much to give some of these materials a stronger place in concrete practice. Their use will continue to increase so long as those who employ them understand the specific function which they perform and realize that they offer no panacea for the many ills that may befall a concrete structure by reason of unsound aggregates, improper proportioning or indifferent workmanship.

Solving the Clearance Problem

FOR MANY years the problem of establishing and maintaining proper clearances over the network of railways of the country has been one of importance. It has assumed greater proportions on some roads and in some sections than in others; but never before has it assumed the importance that it has had in recent years, with the constant tendency towards larger rolling stock and bulkier lading, more acute congestion in the larger terminals, and at the same time, a demand for greater service. Shipments of unprecedented dimensions are being offered to the railways with increasing frequency and there is every indication that this condition will continue on even a larger scale. This will mean increased business for those roads which are able to handle large shipments safely, and which are in a position to advise shippers promptly, how, when and where they can be moved.

The importance which the Pennsylvania attaches to this phase of railroading, and the thorough manner in which it handles its clearance problem, are described elsewhere in this issue. That this road is justified in its efforts in this regard is evident from the fact that, from a relatively small business in the handling of shipments of excessive size 20 or 30 years ago, its traffic of this nature is so large at the present time that approximately 2,500 special cases involving large shipments have to be analyzed each month by its clearance engineers.

Practices in handling clearance problems on the various roads differ as to jurisdiction, organization and methods. On some roads they are handled by the construction department, on others by the maintenance of way department, and on still others, as on the Pennsylvania, by a special clearance department, reporting to the chief engineer. Regardless of the department which has direct charge of this work, much of the success of a road in establishing and maintaining adequate clearances and accurate clearance records, depends upon the co-operation of the maintenance of way department. It is this department, with its corps of engineers and supervisory officers who virtually live on the right-of-way, that is best fitted to report and to remedy unfavorable clearance conditions. It is this department which is always constructing, installing and re-arranging roadway facilities, and which invariably has a hand in approving the location of industrial facilities on the right-of-way, whether overhead or alongside the tracks. It is this department which can defeat the most careful work of those charged with the duty of establishing and recording clearances, by the indiscriminate raising or relining of tracks in close-clearance territory, or by increasing the superelevation on curves where close side-clearance prevails; and it is this department which can add to the worries of the clearance engineers by carelessness in piling maintenance of way materials along the right-of-way.

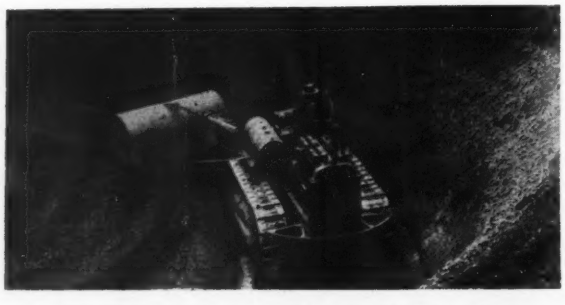
In these ways and others, the maintenance of way department, whether directly or indirectly responsible for roadway clearances, can affect the clearance conditions prevailing on a road. It has, therefore, a large responsibility in this regard and needs be vigilant to increase clearances where possible, and to oppose or to refrain from any move which would further restrict established clearances so that accurate and up-to-date records can be kept at all times. Such co-operation on the part of the maintenance of way department, beginning with the foremen, is indispensable in any solution of the clearance problem.

When Must a Tank Be Renewed?

THE PRESENCE of a wooden water tank, green with a luxurious growth of moss, on an important double-track main line, calls to mind the oft-raised question as to when a water tank is "ripe" for renewal. The facetious answer once given, that it should be replaced when the water leaks out faster than it can be pumped in, is of course beside the point. Nevertheless, there are many tanks in use today which have served their purpose for several years after they had been condemned as unfit for service.

Judgment in such matters is sometimes warped by the influence of other considerations. For example, there is the story of the tank which was recommended for replacement by one of twice the capacity, with the statement that the old tank could not be expected to last another year. Authority was duly received for the renewal of the tank, but with one of the same size. As the division officers felt that greater storage capacity was necessary, they arranged to leave the old tank in service after the new one had been erected and continued to benefit from its use for a number of years.

Like any other structure, the general rule to apply is that renewal is justified whenever the annual expenditure for repairs exceeds the annual carrying charge for a new structure. However, like a bridge, such a rule is subject to qualification in its application, because of the need for guarding against the approach of a condition that introduces serious hazard of failure. While failure of a water tank is by no means fraught with as grave consequences as a bridge failure, it may lead to serious difficulties. It is true also, that many tanks have been renewed because of inadequate storage capacity. It is to be questioned, however, whether it is ever expedient to recommend the renewal of a structure on any other ground than that upon which it can be honestly supported. Sharp practice may be fruitful of an immediate gain, but it begets distrust which will be hurtful in the long run.



A Caterpillar Tractor Operating a McMillan Scraper

What Our Readers Think

We Were in Error

Nashville, Tenn.

TO THE EDITOR:

Since my return home after an extended absence I have noted the article in your August issue entitled, "Catching Up With the Locomotives." I quote the following from the first column on Page 331:

"In 1923, the Atlantic Coast Line, the Nashville, Chattanooga & St. Louis and the Kansas City Southern adopted 100-lb. rails as standard for their heavy traffic lines, the first named having used 90-lb. rails previously, while the heavier sections supplanted 85-lb. rails on the K. C. S. and 80-lb. rails on the N. C. & St. L."

The above statement is wrong with respect to the N. C. & St. L. We had used A.R.A. Section "A" 90-lb. rails in our principal main lines for many years prior to 1923.

In this connection, it may be of interest to record the history of how the 110-lb. rail came to be rolled. Prior to 1923 the rail mills had declined to roll this section on the ground that existing 105 and 107-lb. sections rendered this new section unnecessary. In 1922 this company secured from one of the mills an agreement to roll its requirements in the 110-lb. section, but before the order was placed this agreement was withdrawn and we continued to use 90-lb. rails. Subsequently an order of 50,000 tons was placed with this same mill by another company. This order enabled us to secure the 110-lb. rail for our 1923 requirements and this has been our standard for heavy-traffic lines since that date.

HUNTER MCDONALD,
Chief Engineer, Nashville, Chattanooga & St. Louis.

New Books

The Bunkhouse Man. By Edmund W. Bradwin, Ph.D., Director of Instructors, Frontier College, Toronto, Canada. 300 pages. 6 in. by 9 in. illustrated. Published by the Columbia University Press, New York. Price $5.

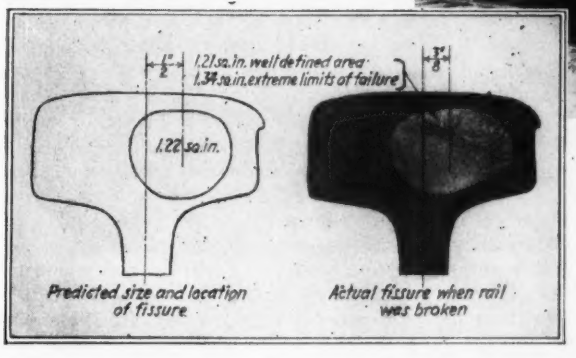
This book, which is in reality a study of work and pay in the labor camps of Canada in the period from 1903 to 1914, was based on 24 years of practical experience with the work and pay of men in frontier places across Canada. Primarily, the book deals with labor camps along the National Transcontinental, now a part of the Canadian National Railways, and it is written from the standpoint of the worker, rather than the employer.

Following an outline of the historical development of transportation in Canada and the background of the navvy, or common railway worker, the author explains the contract system of railway construction and then vividly pictures the methods employed in hiring campmen, their work, pay, and housing conditions. Within this section are described the evils which were rampant in the hiring of men, the system of board and pay in effect and the arduous nature of the work, together with the primitive and unsanitary housing conditions provided.

Throughout, the book is historical, educational and constructive. Credit and indictment are given freely to laborer and employer alike, and in the latter chapters, many practical suggestions are made for improving the condition of the campmen, which, in many instances, even at the present time, is depicted as far from that which is to be desired.

Transverse Fissure
Is No Longer a Hidden Menace

Newly Developed Device for Finding Concealed Defects in Rails Proves Practical and Effective


1.21 sq. in. well defined area
1.34 sq. in. extreme limits of failure
1.22 sq. in.
Predicted size and location of fissure
Actual fissure when rail was broken

The A. R. A. Detector Car and Heavy Duty Motor Car Used for Observations on the New York Central. At the Left—An Evidence of the Accuracy of the Detector—the Predicted and Actual Conditions

AFTER repeated unsuccessful attempts during the last 15 years to devise a way to detect hidden defects in rails, and particularly transverse fissures, equipment has finally been perfected which has demonstrated its ability to locate these defects before complete failure occurs. This equipment, which is known as the Sperry transverse fissure detector, and which was developed for, and with the co-operation of, the American Railway Association and the American Railway Engineering Association, is so designed that it not only searches out and indicates on a permanent record the locations and relative sizes of all internal fractures in the heads of rails, but also marks the precise locations of such fractures directly on the rails themselves, by means of a paint spray.

General Description of New Equipment

The new detector equipment, which is operated and controlled entirely by electricity, forms a complete, self-contained unit, compactly arranged on the platform of a heavy-duty trailer car and entirely enclosed against the elements by a frame housing fitted with windows on all four sides. When in operation, the entire unit is pulled over the track by a motor car at a speed of about five miles per hour and, under the observation and direction of two operators, functions entirely automatically.

The fundamental principle utilized in the new detector equipment is based on the fact that if the rail is made to act as an electrical conductor and is saturated with a very heavy current, all internal hidden flaws encountered, including occlusions, shattered zones, pipes and fissures, present obstructions in the path of the heavy current forced through the rail. This is true even though the flaws are very small, and regardless of whether they are disposed horizontally, at an angle, or are truly transverse to the longitudinal axis of the rail. In other words, when the saturated current reaches any of these flaws or fissures, it cannot proceed in a straight line, and is, therefore, required to make an abrupt change in its direction in passing around the obstruction. The primary feature of the new transverse fissure detector car is a special device, located in the region between the points where the heavy current enters the rail and leaves it, which immediately detects any deviation or abrupt change in the direction of the current within the rail.

The principal units of the detector equipment for locating defects in rails consist of a gasoline engine-generator set, rail contact brushes carrying the energizing current to the rail, and the special device which passes along the top of the rail head, for detecting and measuring the abrupt current changes referred to above. As these changes in the direction of the current produce only a very feeble manifestation, this is carried to amplifiers, similar to those used in radio reception, which build it up to a point where it can be utilized for operating relays. The relays, in turn, control electric circuits of larger capacity, which operate all of the recording instruments.

The principal recording instrument of the detector equipment consists of a series of seven electrically-controlled recording pens that bear or ride on a continuous strip of paper which moves over a table. Six of these pens are transverse fissure indicators—three for each line of rails, the seventh indicating the location of the joints in the track. Supplementing this paper record, a paint gun on each side of the car automatically sprays a spot of paint on the track rail, precisely at the point where the detector equipment indicates a defect of some character.

Early Detector Equipment Proved Impractical

During the 15 years immediately preceding the successful development of the present A. R. A. detector car, three principal methods, or principles, have been experimented with in an effort to develop a satisfactory

device for detecting transverse fissures. These were a mirror mounted on a special frame for movement along the rail, whereby visual inspection could be made of the underside of the rail head; the magnetic principle, wherein the rail was magnetized, and flux leakage, due to irregularities in the material, was detected by search coils; and the measurement of the resistance effect of discontinuities in the rail head by energizing the rail and then detecting the minute difference in potential resulting at transverse fissures. All of these methods, including the last, which was the principle upon which the Sperry detector equipment was first based, have been discarded. The mirror method was both slow and laborious and had the further serious limitation that the detection of failures was possible only when the interior defect had reached the surface of the rail section, at which time the rail was practically ready to break. The magnetic apparatus proved highly sensitive and its development was discontinued as impractical because it produced results from which it was impossible to differentiate between transverse fissures and such other head irregularities as result from the slipping of drivers, gagging and cold bending of the rails, accidental spike maul blows on the rail, the cold rolling effect of wheels, segregation, laminations, etc.

After having given highly satisfactory results in extended laboratory experiments, the Sperry method of measuring the difference in potential caused by the presence of fissures in rails was also discarded soon after experiments were made under actual track conditions, in spite of the fact that the greatest optimism was felt for its success. On the whole, the equipment was found to be fundamentally correct and properly arranged, and the impractical factor was due, not to the method itself, but to the fact that the rails in track were found to be coated with a superimposed layer of hammered-in enamel, usually consisting of insulating ferro-ferric oxide some thousandths of an inch in thickness. The thickness of this layer of enamel seems to be in proportion to the density of traffic and, in some instances, where this layer is heavy, all of the cold forging of the rail by wheel action, to which the deformation of the rail is due, apparently goes on through the layer.

In an attempt to overcome the difficulty presented by this layer of insulating material, several types of cleaning brushes were experimented with, but in each instance with unsatisfactory results. The only method found by which it was possible to get down through this layer to the actual surface of the steel rail itself was through grinding. This process was effective but was found to be altogether too slow to be practical, and therefore, new research had to be instituted to overcome this serious difficulty. Further difficulties were imposed by the presence of rust, dirt, mill scale, and other irregularities commonly found on the surface of rail heads.

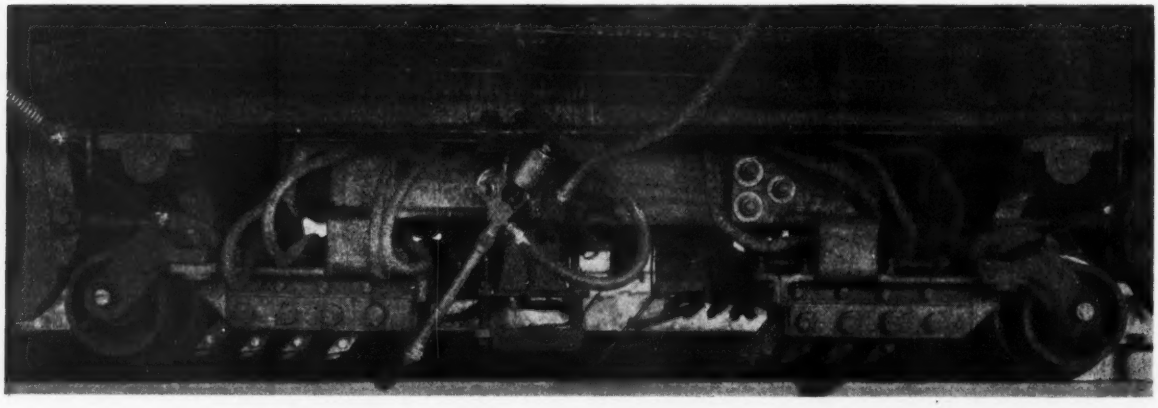
After several months of experimenting with this method of detection on a special test section of track on the New York Central, in which a considerable number of rails known to have transverse fissures were laid, and also on the main line, the entire method then used to detect fissures was changed to the new method now employed. As a result, the present transverse fissure detector equipment differs in many respects from the equipment under test early in the year.

Electrical Equipment and Circuits

The present equipment, which consists essentially of a gasoline engine-generator set, rail contact brushes, a pick-up device, amplifying tubes, a number of relays, a recording table with electrically-operated pens, a paint gun unit for marking the location of fissures, and rail cleaning brushes, is mounted on a standard steel-frame Kalamazoo trailer car equipped with four-wheel hand-operated brakes. Above the platform, this car is enclosed in a special frame housing, the upper half of which is fitted with drop sash windows on all four sides. The car is equipped with a drawbar and, when in actual operation, is pulled over the track at the rate of about five miles per hour. Motive power for pulling the detector equipment on the New York Central was furnished by a Casey Jones motor car equipped with a Ford engine. On other lines, however, it is planned to pull the car by such suitable power as the roads can provide.

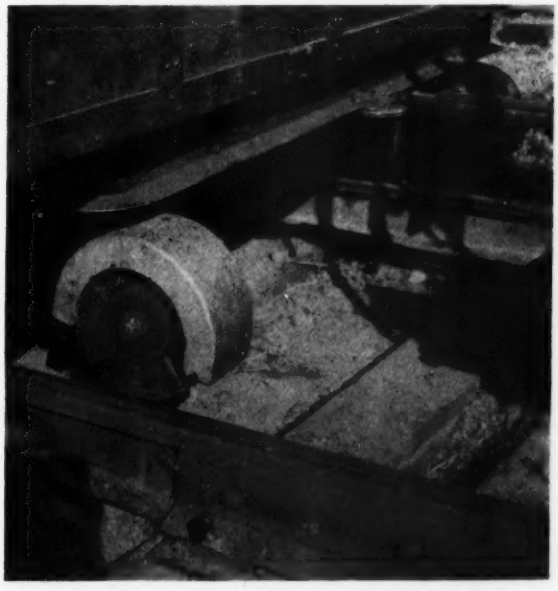
The power plant of the detector equipment is an engine-generator set consisting of a separately excited d.c. generator with a rating of 4,000 amperes at 2 volts, operating at 900 r.p.m., which is direct-connected to a 25-hp. water-cooled Waukesha gas engine. The exciter unit, which is a d.c. generator capable of developing 10 amperes at 110-volts, is belt-connected to the main drive shaft of the gas engine. This equipment is compactly arranged across the forward end of the car platform.

From the generator, the current developed is carried through heavy copper conductors to bus bars on each side of the car, which, in turn, are connected by separate conductors to each of the rail contact brushes. In all, there are 32 such brushes, assembled in four groups of eight brushes each, two such groups being located in line with each other on each rail and spaced about



One Pair of the Brush Carriages, the Pick-up Device and the Paint Spray

three feet apart. In each of these contact assemblies the brushes are arranged in four sets of two each, located directly behind each other, and are held in a rigid brass brush carriage. The brushes themselves are solid copper bars and have a mitered rail contact face so as to present a maximum contact surface to the rail. This is the main point of difference between the present type of brushes on the car and those used during the early experiments, the old type brushes having consisted of layers of wire gauze, compacted into more or less flexible bars. As was the case with the old brushes, the new type brushes are pressed against the head of the rail by heavy springs, forming a part of the brush carriages. The brushes of the new type have been found better adapted to the service demanded and, being rigidly pressed against the rail, effect sufficient contact with the steel through the surface coating of insulating ferro-ferric oxide to transmit the current.



One of the Rotary Wire Brushes Which Clean the Rail Head in Advance of the Contact Brushes

The weight of each brush assembly, when lowered to the rail, is carried by two flanged wheels, one at each end of the brush carriage. In addition, these wheels, which are held tightly against the gage side of the rails by springs, insure the accurate integrity of location of the whole electric system with respect to the rail.

Both brush carriages on each side of the car are hung from a suitable side beam and are raised and lowered simultaneously by the operation of a hand lever inside the car. When in the lowered position, the brush carriages are independent electrically and practically independent mechanically from the car frame, the only mechanical connection being that sufficient to hold the carriages properly in a vertical position and to move them along the rail. When in a raised position, the carriages are held rigidly against the frame of the car.

How the Equipment Detects Defects

With this arrangement of brushes connecting the generator and the rails, the rail sections between the brushes on each side are energized and form parts of closed electrical circuits. When so energized, the path of the electrical flux through a section of perfect rail is constant. When a transverse fissure or other flaw is encountered, however, there is an immediate change or distortion of the direction of the current flux in the rail in passing around the obstruction, the severity of which indicates the relative size of the fissure or other flaw encountered.

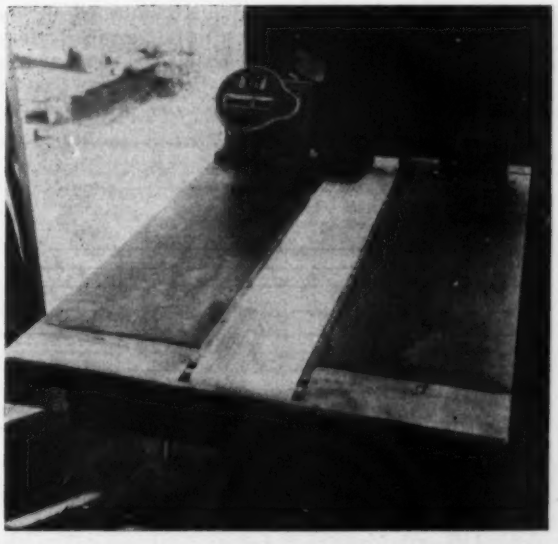
Through specially designed apparatus mounted on each side of the car, all of these abrupt changes in the direction of current flow in the rail are detected. In addition, this apparatus interprets in terms of magnitude the changes in the current direction above referred to, and produces slight energizations which pass through electric circuits to amplifiers housed on a table in the center of the car. These amplifiers are of the ordinary heterodyne type, and step up the induced voltage approximately 25,000 times.

From the amplifiers, the amplified energizations pass to a group of 12 special relays, suitably arranged on a platform over the top of the table referred to, and connected in circuit with the recording pens and air valves on the paint-spraying equipment. The relay circuit for operating the recording pens carries 6 volts secured from the starting storage battery of the gas engine, while the relay circuit for the operation of the paint spray air valves carries from 80 to 110 volts, secured directly from the generator exciter.

Makes Paper Record of All Defects

The device for producing a graphical record of conditions found in the rail consists of a recording table, on top of which travels a friction-driven strip of paper from a roll supply, which moves over the table at the rate of 1/16 in. per ft. of track covered by the car. Directly in contact with the paper are seven pens which are actuated as the pen relays are affected by changes in the energy received from the amplifiers.

Fissures located in the two track rails are indicated on the paper by six of the pens, separate groups of three pens indicating the fissures in each rail. The seventh pen, which is located between the groups of fissure-indicating pens, records the location of joints. In recording the detection of a fissure, the relays are so adjusted that a short transverse line is drawn by two pens if the internal break is of intermediate size; and all three pens operate if the break is of large area. These



The Recording Table, with Its Pen Instrument, Speedometer and Joint Counter

three degrees of grading indicate roughly failures of 7, 15 and 25 per cent of the rail head area. Visual check on the proper functioning of the recording pens is afforded through suitable indicators connected across the output of each of the amplifiers.

Thus, seven lines are produced on the graphical record—the three lines on the left indicating defects in the left-hand rails; the three lines on the right indicating defects in the right-hand rails, and the middle line indicating the position of joints. A numering machine, which records consecutively the number of rail joints passed over on one side of the track, makes it possible to number all rails on the record which show the presence of transverse fissures.

In addition to the graphical record produced by the pens, an actual indication of the location of fissures is produced directly on the track rails through the paint spray unit which forms a part of the detector car equipment. This unit, which was furnished by the DeVilbiss Company, includes a spray gun mounted on each side of the car and directed toward the web and base of the rails. Air for the operation of the guns is furnished by a small air compressor, which is mounted under the forward end of the car and driven through a belt connection with the shaft of the engine-generator set.

Operation of the paint spray gun on each side of the car is, in each case, through the opening and closing of a magnetic air valve located below the floor of the car and actuated by one of the paint relays. Ordinarily the gap between the rails at each joint would cause the paint spray equipment to operate, but this has been precluded through special devices which prevent the operation of the paint spray without affecting the operation of the pens.

Auxiliary equipment used on the detector car includes a speedometer mounted on the recording table, in order to keep a check on the speed at which the car is being operated; a switch and meter panel connected in the circuit of the generator current; a metal storage battery box, and a pair of rotary wire brushes for cleaning the surface of the head of the rail in advance of the contact brushes. These cleaning brushes, one of which is mounted directly over each rail at the head end of the car, are made of steel wire and are about 10 in. in diameter. Both brushes are belt-driven from the engine-generator shaft and operate at a speed of about 2,500 r.p.m.

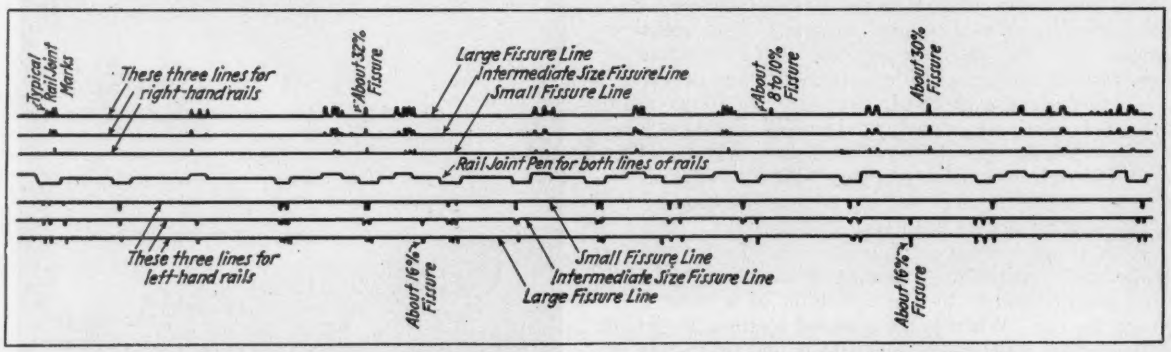
First Service Run of Equipment Is Successful

At the present time, the detector car is being operated over main-line tracks, under train order, by two men, in addition to the motor car operator in charge of the tow car, and a conductor and a flagman. No provision is made for setting the car off from the track, it being necessary to clear trains at passing tracks or sidings.

In its first actual service run, which was completed about the middle of November, the car was operated over the two main tracks of the New York Central between Beacon and Rensselaer, N. Y., a total distance of 166 miles. Within this territory, approximately 53,000 rails were covered, which have been in the track an average of about 5½ years. In all of this distance, defect indications were recorded on only 0.06 of 1 per cent of the rails, these varying from a few indications of relatively strong intensity to a greater number of indications of moderate or weak intensity. On the second road on which the machine operated, a still smaller number of fissures were discovered. On 150 miles of road, however, where the rail was from 10 to 15 years old, the number of fissures found greatly exceeded these figures.

Looking Forward in the Car, Showing the Relay and Amplifier Table. Paint Spray Tank and Meter Panel

Further details of the record established by the car on the New York Central are not available at this time, as a complete analysis has not yet been made of the results of the initial run, or of the record of a check run over a portion of the territory originally covered. On the initial run the car covered an average of from 18 to 38 miles per day, depending upon the conditions encountered, while on the check run, in which record was made over portions of the track only, the car averaged about 40 miles per day.

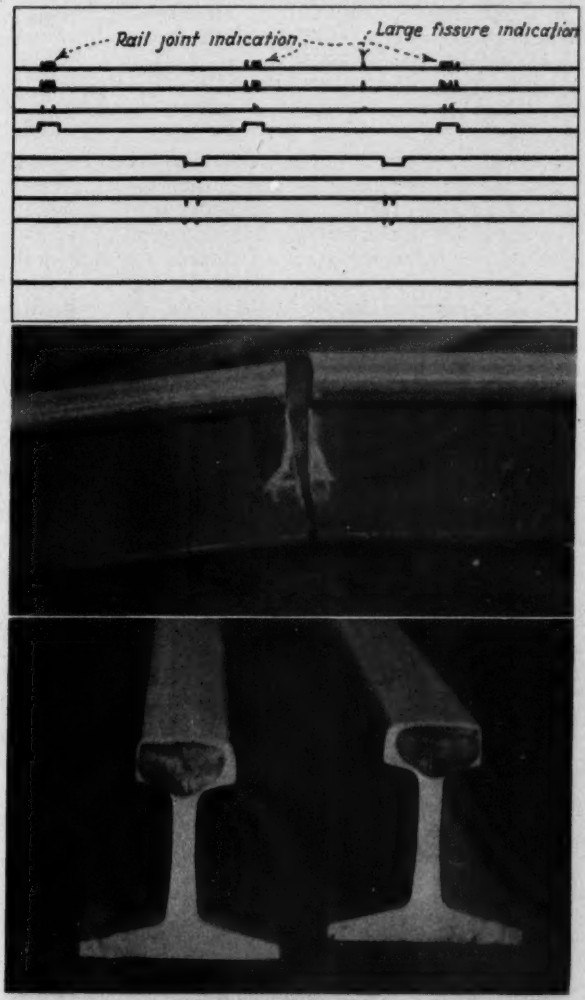

Typical Rail Joint Marks
These three lines for right-hand rails
About 32% Fissure
Large Fissure Line
Intermediate Size Fissure Line
Small Fissure Line
About 8 to 10% Fissure
About 30% Fissure
Rail Joint Pen for both lines of rails
These three lines for left-hand rails
About 16% Fissure
Small Fissure Line
Intermediate Size Fissure Line
Large Fissure Line
About 16% Fissure

A Section of the Record Made by the Detector on a Section of the Special Test Track

Many Co-operated in Developing Detector Car

The experimental and development work which has resulted in the present transverse fissure detector equipment was begun about five years ago when E. A. Sperry,

of the Sperry Development Company, Brooklyn, N. Y., conceived the idea of utilizing the air-gap resistance effect of disassociated particles or areas in the interior of rail heads to disclose their identity. Mr. Sperry outlined his plan to the Rail committee of the American Railway Engineering Association, and, after a careful investigation, an initial appropriation was made by the association for a co-operative experimental study of the proposed plan in the laboratory of the Sperry Development Company. As a result, laboratory equipment was designed and assembled which, under test, became so proficient that the size and location of each internal transverse fracture or fault in the rail head could be ascertained with a high degree of accuracy. Following



An Example of the Detector's Work
Top—An Indication Recorded by the Sperry Detector Car. Middle—The Rail Broken Precisely at the Point Indicated by the Detector. Bottom—The Transverse Fissure Found at the Break

these tests, an agreement was reached between the Sperry Company and the American Railway Association, in August, 1927, for the construction of a track car for the detection and marking of the internal failures of rails in the track. This car was completed early this year and was put under test on a special test track in the yard of the New York Central at Beacon, N. Y., in which were laid sections of rails in which transverse fissures had developed in service. While the result of the first actual service tests were highly encouraging, it was these results and the results of subsequent tests made on the high-speed main line tracks of the New York Central, which led to the final change in the method of detecting the location of fissures.

From the above, it is evident that credit for the successful development of the present equipment for detecting and indicating the location of transverse fissures in rails in the track is due a number of individuals and organizations; to E. A. Sperry and the Sperry Development Company; to the American Railway Engineering Association and the American Railway Association, and to the New York Central which has

The New Commercial Detector Outfit of the Sperry Rail Service Company

extended every assistance to further the successful completion of the car. Directly representing the Sperry Company during the development of the detector equipment has been H. C. Drake, assisted by J. A. Drain, Jr., while the American Railway Engineering Association has been represented by Earl Stimson, chief engineer maintenance of way of the Baltimore & Ohio, and chairman of the Committee on Rail; W. C. Barnes, engineer of tests for the Rail committee, and by C. B. Bronson, assistant inspecting engineer of the New York Central and a sub-committee chairman of the Committee on Rail. The assistance given by the New York Central, and all operations of the car on that road, have been under the direction of J. V. Neubert, chief engineer maintenance of way. The operation of the car is under the general direction of the Rail committee of the American Railway Engineering Association, with direct supervision by W. C. Barnes, engineer of tests for the committee. The operator of the car is Henry W. Keevil.

When the detector equipment was officially accepted by the A. R. A. at Beacon on October 2, nine of the different roads having membership on the Rail committee of the A. R. E. A. had representatives present. While definite future plans for the operation of the equipment have not been formulated, under the present plan in effect, it is being assigned for a test period of six days to each of a number of roads in the East and South. Within this period each road will have full jurisdiction over the actual operation of the car, using it on such lines as it may select.

Second Car Now Engaged in Commercial Work

In view of the demand for the service of the newly developed transverse fissure detector equipment and the desire of several of the roads to have their lines serviced by this equipment in the hands of experts, rather than to purchase one of these cars at this time and to operate it themselves, the Sperry Development Company has built a second car, which was completed early in November and is now operating on certain western lines.

Profiting by the experience gained in building the first car, the second car incorporates several additional features which are expected to facilitate the work of the operator and produce a more valuable and effective record of the conditions found in the field. In the main, the electrical equipment and the principles involved are essentially the same as those embodied in the A. R. A. car.

Changes in the Newer Car

One of the principal changes in the newer car is found in the arrangement of the equipment and working space. The newer car has a working space transversely across the center, while the space across the rear end is occupied by the amplifier and relay table, the meters, and the recording instrument table. So arranged, the operator can sit facing the rear of the car, watch his equipment, and at the same time have a clear view of both lines of rails behind him.

Another change incorporated in the newer equipment is in the recording instrument, in which two additional pens have been provided. One of these is an additional joint-indicating pen, so that there are now two joint pens in the new instrument, one for each line of rails, and the other is called a landmark pen. This latter pen ordinarily produces a continuous straight line, parallel with the other pen lines, but a jog can be produced in it when desired by closing a contact switch provided in the motor car which pulls the detector car. Thus, as the outfit moves over the track, the tow car operator, by closing the landmark pen contact switch beside him, can indicate directly on the record the precise locations of mile posts, bridges, signals, highway crossings, telegraph poles, etc. As he closes this switch to produce a landmark indication on the record, he advises the detector car operator of the specific object passed, by means of a telephone, so that the detector car operator can make a proper notation on the record opposite the indication made. In the telephone circuit provided, transmission is one way only; no provision is made for the detector car operator to talk with the tow car operator. In lieu of this, however, a buzzer circuit connects the two cars so that through a simple code, the detector car operator can transmit operating instructions to the tow car operator.

Another feature included in the new commercial car, primarily as a precautionary measure against damage to the electrical contact brushes, is an air-operated brush lifter, which raises or lowers the two brush carriages on the car separately. This is operated by the tow car operator who raises the carriages each time the car is stopped. In order to preclude the possibility of a reverse movement of the car with the brushes in the lowered position, which in all probability would damage them at uneven rail joints, the brush lifting device is arranged to work automatically, raising both brush carriages, with the slightest movement of the car in the reverse direction.

Has Special Tow Car

In order to adapt the commercial equipment to operation over heavy grades, and in inclement weather, the tow car provided for use with the detector car is a specially enclosed and equipped motor car. This car, which is a heavy-duty Kalamazoo inspection car with a 35-hp. engine, is enclosed in a manner similar to the detector car, with glass panels on all four sides to give the operator a clear view in all directions.

As the operators of the detector car and the tow car will, of necessity, be confined rather closely to the equipment both day and night while out on the road, the tow car is suitably fitted to afford them conveniences and sleeping facilities. In the arrangement provided there is a small toilet room, a wash stand, fed from a large overhead water container, one permanently fixed bunk, and one moveable bunk which is raised to the ceiling of the car during the day. In addition, the car is equipped with electric lights and is fitted with a comfortable wicker chair and a small table. The new detector car outfit just described is being operated by the Sperry Rail Service Company, Chicago, a company organized recently to give this service to the railways.

Paper Bags Prove Water-Tight

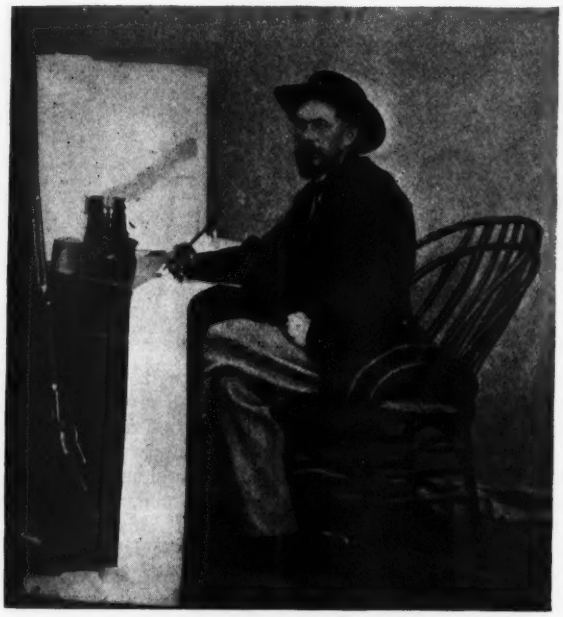
A DEMONSTRATION of the effectiveness of paper bags in protecting cement from damage by water was obtained recently as the result of a fire in a warehouse at Tennille, Ga. The facts are clearly set out in the following letter written by one of the owners of the building:

"The fire originated in the middle of the building and burned for thirty minutes or more, while for the greater part of an hour, two streams of water were played all over the inside of the building and its contents. We had just started unloading a car of cement (in multi-wall paper bags) into our warehouse and had put about fifty bags of it near the middle of the house where the fire originated.

"The greatest damage to our stock of goods was water damage, since thousands of gallons of water were poured over the contents. When the water was turned off, the floor of the building was covered with about three inches of water. Our first impression, of course, was that the cement stored in the building was ruined. Upon investigation the next morning, however, we found that every bag of the cement was in perfect condition, and we later sold it without any reduction in price."

H. M. FRANKLIN & Co.

The bags referred to were multi-wall paper bags manufactured by the Bates Valve Bag Corporation, Chicago, to whom the letter was addressed.



Samuel B. Reed, First Chief Engineer of the Rock Island

Making the Most of the Expenditure for Labor

A Study of the Economics of Labor Saving Devices and a Plea for Uniform Maintenance Forces

A Striking Example of the Use of Power Devices

A REVIEW of the progress made in the development and application of labor-saving equipment and tools and an analysis of the advantages of steady employment of men engaged in maintenance of way work were treated in two papers presented before the Western Society of Engineers, Chicago, on November 26, under the auspices of the Railroad section of the society. The first paper, presented by John B. Mabile, supervisor of work equipment, Chicago, Rock Island & Pacific, comprised a rather detailed consideration of the various classes of power equipment and tools now in use. This was followed by a paper by Charles A. Morse, chief engineer of the same property, which dealt almost entirely with the human side of the problem of employing labor, stressing in particular the need for continuity of employment and the advantages to accrue from a plan for uniform forces throughout the year, from the standpoint of both the employee and the employer. Abstracts of both of these papers follow:

Current Progress in Labor Saving

By JOHN B. MABILE

Supervisor of Work Equipment, Chicago, Rock Island & Pacific, Chicago

IT IS ONLY a few years ago since our material handling equipment consisted of steam shovels, Lidgerwoods, Barnhart plows, apron flats, side-dump ballast cars, chain-lock dump cars and bulldozer spreaders. Possibly the greatest improvement in labor saving devices and machines has been made in this field. The Lidgerwoods, Barnhart plows, apron flats, side-dump ballast cars, chain-lock dump cars and bulldozer spreaders have been discarded on our line, leaving the steam shovel the only unit of the old equipment now in service. It will, in all probability, be with us for a long time for large jobs, but on small jobs of, say, 10,000 to 15,000 cu. yd. in a place, ballast pit work and coal handling, the steam shovel has now been replaced by locomotive cranes, caterpillar shovels and steam ditchers. For many of these purposes self-propelling units are coming into general use.

The Lidgerwoods, Barnhart plows and apron flats were first replaced with the old chain-lock dump car. This was followed with the air-lock dump car, and now it in turn is being superseded by the trunnion-type car that requires no locking device and dumps in such a manner that it frees the car of the load better than the other types and, at the same time, places the flow line of material further from the center of track and nearer the top of rail. This means handling of material without fouling the rail.

The bulldozer spreader was replaced by the old air-lift, manually-operated brace machine built on a wood frame car. Following this, we had steel air-operated spreaders that required no hand placing of braces. The latter has been improved on in the latest machines offered, which are entirely air-operated, while the wings can be stopped and material spread to any desired width up to 24 ft. from the center of the track.

Improvements in Ballast Cars

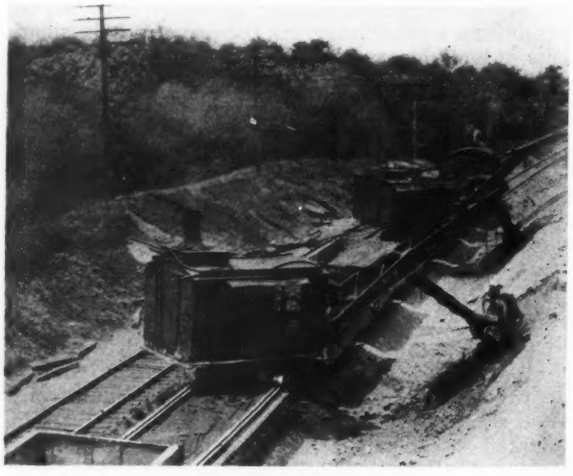
The side-dump ballast car was replaced with the center-dump non-convertible car, which was satisfactory for distributing ballast, although the cubic capacity of the car was such that it could not be utilized in the off season for handling coal or other commodities. It was replaced, in a short time, by the convertible ballast car, which was used as a center-dump ballast car during the working season and then converted to a flat bottom coal car. This car has been replaced with the new type of steel ballast car which requires no conversion or pre-arrangement

of the dumping mechanism when transferring it from ballast service to coal or other revenue service, with the added advantage over the old cars in that the lading can be either center dumped or side dumped, or part can be dumped in the center and part to either or both sides as desired.

Ditching Equipment

Following the old push car and hand dump boxes, we devised a flat car with a 10-in. by 12-in. timber bolted on it crosswise, to which we chained a large plow to loosen up the dirt in cuts, which was later loaded by hand. The next improvement in this method was in the old scoop drag-type ditcher to load the dirt after it had been plowed in this manner. Following this, we had the steam ditcher and next the spreader-ditcher. The steam ditcher is still the most effective machine for this purpose when the dirt removed from cuts is to be taken to some particular place, although we found this year that a ditcher equipped with a gasoline engine for power led 12 steam machines in a 30-day test. The indications are that the gasoline or Diesel engine will in time displace the steam engine for this work.

Self-propelling steam ditchers, capable of handling a second ditcher and four dump cars at a maximum speed of about 25 miles per hour, are being used on some roads. This type of machine eliminates the locomotive and crew and thereby effects a considerable saving. The machines have not come into general use, nor have they been in service long enough to develop the cost of keeping them in repair, but the results obtained by the roads using them indicate that this type of machine has marked possibilities.



Two Steam Ditchers Operating in One Train

The last machine to be brought out for this purpose is the spreader-ditcher, which has been improved from time to time. It is very useful for trimming up cuts; it is also effective for cleaning out cuts where it is desired to waste the dirt on fills near the ends of cuts. The machine does economical work and in cleaning cuts where the haul is not longer than 1,500 cu. ft., it will handle a greater yardage than a steam ditcher, with the added advantage that, when properly used, it does not foul the ballast in the cut or on the fill, and leaves the cut dressed properly, thus dispensing with hand labor for trimming. We have just tried out one of these machines built to our specifications and embodying some new features. It has an air-controlled, box ditcher attachment; with it we can ditch a cut, place the dirt on the fill, which it will widen to standard, dig the box ditch in the cut and dress the entire job in a way to avoid any hand labor behind the machine, with the single exception of a few minutes opening the spillway at the end of the box ditch.

It is not many years since we were using the old wooden lever, about 6 in. by 8 in. square and 16 or 18 ft. long, for raising track. This was replaced by friction jacks, that were later replaced by ratchet jacks. Improved ratchet jacks are still in use, although for heavy work and where large gangs of men are employed raising track, the track raising machine has been found very economical. The cost of operating it (fuel, lubricants, repairs and operator) amounts to about the same as the pay of four men, while on a heavy job such as grade revision, it releases 14 to 16 men for productive work that were formerly employed in handling jacks, bars and blocks and digging jack holes. For shifting tracks on construction jobs, in ballast pits, at coal storage yards, waste piles, etc., this machine has proved that it will do the work of 50 or more men.

Track lining used to be a very laborious task and on some of the lighter traffic lines where small forces were employed, it was necessary to double up section gangs to do a job of ordinary lining. The track liner has come into general use for this purpose, and several types are offered that increase the man power to such an extent that two or three men can line an average piece of track, while six to eight men equipped with liners can line almost any switch.

For dressing track behind ballast gangs, there are machines equipped to dress the ballast to the standard cross section of the individual road, the shaping wing being provided with a carrying wing that will pick up surplus ballast and carry it along to the weak spots.

Rail Handling Machines

It was not so long ago that rail-handling devices were confined to the old hand tongs, track chisels, punches and sledges. There was no device in general use for loading and unloading, and rail had to be shipped on flat cars, drop-end coal cars, or stock cars having an end door. In unloading, the rail was dropped off the side of a flat car or pulled out of the end of the other types of cars, onto an "A" frame on a push car to land it outside of track.

First the "three-man" rail layer replaced the tong gang. Next came the light gasoline-type crane for this purpose and later the gasoline-electric machine, both of which are now in use, with some difference of opinion as to which type is more flexible and satisfactory. To these two machines have been added the various types of locomotive cranes and steam ditchers. By their use, rail can be loaded in or unloaded from any kind of an open car. These machines are now being equipped with a generator and a magnet for picking up rail and old fastenings behind relay gangs and for general use in cleaning up scrap.

The track chisel, punch and sledge have been replaced, to a great extent, by electric saws and drills, driven by current from gasoline-electric cranes. We have one gasoline-electric plant that generates sufficient power to operate eight saws and two drills and has been used for sawing rail in track as well as from storage piles. We also have individual power hack saws and drills, operated by a small gasoline engine. In addition, we have tried out air-operated

wrenches and spike drivers and the results obtained indicate that this type of tool will soon come into general use. We have a large, semi-portable, steam power rail saw, that is used when we have a big job of sawing and drilling rail.

Weed Destroyer Machines and Methods

I believe that the first machine offered for killing weeds was a gasoline-propelled weed burner, which also used gasoline as fuel for burning. This proved very expensive and met with so many objections that its use was discontinued. Next we had the superheated-steam weed destroyer which killed but did not remove the weeds. Later, there were developed flame burners, using a gasoline engine for power and low grade fuel oil for burning the weeds. The first few of these burners were crude and the mileage obtained was limited because of the time lost for repairing them, but they have been improved and are now coming into quite general use. The disking machine has been used to considerable advantage by a number of roads to rid the ballast shoulder of weeds.

The Steam Shovel Is Still Used for Heavy Excavation

Chemical weed destruction, although more expensive, has been found to be very effective, where the vegetation, traffic conditions and necessity for a clean roadbed would warrant its use.

Various types of track mowers have been developed, most of which are doing good work. They have been designed to cut the weeds from 6 to 12 ft. outside of the line made by the weed burners, disking machines and chemical destroyers. This not only makes more sightly track, but the keeping of the weeds down for that distance outside of the grass line prevents the seed crop from blowing on the roadbed and lessens the work of the machines that are used to clean the vegetation between the grass lines.

Track Tools

Great improvement has been made in track tools and it is evident that alloy steel in such tools as spike mauls, chisels and adzes, has come to stay. While the cost of the new tools is about double that of the old carbon steel tools, service tests have proved that they are generally good for about three times as much service as the old tools. Their use, however, requires a little more care in rehandling and re-dressing than was given the old tools.

The alloy steel tools cannot be re-dressed by a blacksmith in the ordinary manner and, therefore, the majority of them are made to such form or shape that they can be re-dressed by grinding, which is, of course, cheaper than heating and re-dressing. Special tool grinders have been developed for this purpose, with various attachments for holding chisels, adzes, drill bits, etc., in such a manner that they will be ground to the proper angle. The men in the field should be educated in the use of these grinders, which are not expensive, to avoid the necessity of shipping tools in to a central point for sharpening.

Spraying Machines

Machines for applying paint on bridges and other structures, and whitewash on wing fences, cattle guards and stock pens, and for oiling joints as well as the base of the rail, tie plates and spikes in territory where the corrosion is sufficient to warrant, have been found economical. It is our experience that the spray painting of bridges results in a much better job than hand work, with a saving of from 50 to 60 per cent in some cases.

There are two types of track oilers, either of which does the work much cheaper than can be done by hand. One type, driven by a gasoline engine, has proved economical when oiling the joints only, although it is claimed that it is economical for oiling the web and base of the rail and all fastenings as well. Another type of machine, which is operated with a work train and used to spray the web and base of rail and all fastenings, has been used to good advantage. The question still to be answered is whether the smaller machine can do as good a job as the large machine and do it as economically.

Transportation of Maintenance Employees

A few years ago, our men went to and from work on hand cars and used the old-style push cars equipped with plain bearings to handle material. The hand car has since been replaced, to a large extent, by the motor car which is still being constantly improved. The problem with the motor car has been the development of an engine that would provide plenty of power at a car speed that is safe, and still be light enough so that the car could be readily taken off and on track.

Push cars have been replaced with trailers for hauling men and improved push cars for handling material. It did not take long to find out that the old type of friction bearing would not stand up in motor-car service and about the time that the bearing question was solved for the motor car, we began to find out that the old bearings were inadequate for push cars. This was brought about by the fact that the use of the power car to haul the push cars led to overloading. This called for a new design of car, equipped with the same bearings as the motor car, and with a stronger frame, the design of which was such that it would concentrate the load over the axles. The same was true also of trailer cars for handling men. Accidents resulting from sudden stops of motor cars, with carelessness in the riding habits of men on trailers pulled by motor cars, made it necessary to supply trailers with properly arranged seats.

Vast improvement has been made in the materials furnished, and this also has tended to reduce labor costs. Heat treated bolts and angle bars and lock washers mean less breakage and fewer loose bolts. Tie plates do their part in saving ties and in reducing

the need of regaging the track at frequent intervals.

The adzing of track ties prior to treatment means a great saving in the labor of applying them and gives the plate or rail a much better bearing. Preboring is conducive to better spiking. The framing and sizing of bridge timbers prior to treatment and delivery to the job, mean a saving in labor as well as a better job. Furthermore, all of this adzing, boring, etc., is done by machinery at a cost far below what it would be if done in the field. At our treating plants, we have an adzing and boring machine for track ties; at one plant we also have a portable sawmill, planer and cutoff saw with which we have reclaimed some second-hand material and expect to do more of this.

Conclusions

The use of maintenance labor-saving machinery has developed to such an extent that it deserves intensive study. A few years ago, we were comparing the work done by these devices with that performed by hand labor. Now in a number of instances, we are comparing one type of device with another, and the success of doing work by mechanical means depends largely on the placing of the right machine on the right job.

The railroads are investing large sums of money in this equipment and maintenance work should be arranged so as to keep the machines in operation for the maximum number of days each year. This can be most readily accomplished on the southern roads, or roads that have mileage in the south to which they can assign their machines during the winter months, when they cannot be worked in the northern territories.

I feel that any road that invests its money in labor saving devices should provide a special subdepartment to operate and maintain such equipment. This subdepartment should be headed by a man who is familiar with the machines and with the work that is required of them and who should, in a general way, look after the repairing and manning of the machines and see that the right machine is placed on each particular job.

Steady Employment Is the First Requisite

By CHARLES A. MORSE
Chief Engineer, Chicago, Rock Island & Pacific

I WAS surprised to note a newspaper report of the address of President Green, at the recent convention of the American Federation of Labor, which quoted him as being opposed to the introduction of labor-saving machinery, for I had the impression that the federation recognized that the reason why wages could be maintained at so much higher levels in the United States than in other countries was the greater use of such machinery. To insist that our American men and women should continue to be common laborers is unfair to them. The introduction of labor-saving machinery has raised at least half of those who were once common laborers to less arduous positions, with higher wages and improved standards of living.

New Industries Take Surplus

We have only to look back a few years to realize what has been done to provide employment for those who have been displaced by the introduction of labor-saving machinery. If we consider the number of people who have been employed in the manufacture of gas-driven vehicles and accessories in the last 20 years we will see where a large number of the people displaced by labor-saving machinery in other industries have found employment. We have only to look back about five years to see that the same thing has taken place in the radio industry.

In railroad circles we find this same objection raised occasionally by train and engine men, it being their contention that the increase in the size and tractive power of locomotives have thrown men out of employment. The fact is, however, that the increase in the business handled by our railroads has been greater in proportion than the increase in the power of our locomotives, and that while, for the time being, the introduction of heavier locomotives displaces train and engine men on a particular engine district, it does not reduce the total number of men employed in that class of work.

On the Rock Island during the last 20 years there has been an increase of 113 in the number of locomotives in road service and of 195 in the total number of locomotives, in spite of an increase of 61 per cent in the average tractive power of road locomotives. The increase in gross tons handled in the 20 years was 97 per cent, while the total train miles increased 11 per cent. From these figures, which are probably representative of the railroads in the West, it will be noted that the increase in business during the last 20 years, notwithstanding the falling off in passenger business during the latter half of this period, has been such as to require an increased number of locomotives, irrespective of the fact that the size of the locomotives, as reflected in their tractive power, has increased over 60 per cent.

A careful analysis of the ultimate results of the introduction of labor-saving machinery will show, as with train and engine crews, that the increase in business and the development of new industries is such that no hardship, other than temporary unemployment, results from the introduction of mechanical devices or from the improvement of mechanical devices already in use.

Should Provide Continuous Employment

What we should all try to do is to exert our best efforts toward providing *continuous* employment for all who *want to work*. There is, unfortunately, a certain percentage of people who do not want to work if they can avoid it, and when we see statements of the number of unemployed, it always includes these people who do not want to work, or care to work only just enough to get by.

President-elect Hoover has just placed a proposition before the Association of State Governors in which he suggests the holding in reserve of a certain percentage of our public improvement program so that when there is a slacking up in other work, this public improvement work can be undertaken and help to take up the slack due to depression in private business, giving employment not only to

labor on the improvements themselves, but making work for the steel and woodworking mills, cement plants, stone quarries, and other industries that furnish supplies used on these public improvements. This suggestion is in accord with sound economics, but it will require the arousing of public sentiment to put it into effect.

In railway work, there is one serious obstacle to any efforts to employ uniform forces. That is, the habit of persons interested in railway securities, of comparing earnings statements from month to month and of one month with that of the same month of a previous year. This imposes great pressure on railway officers to make a showing each month as compared with the same month a year earlier. Aside from this condition, there is no reason why maintenance work cannot be carried on throughout the year with practically a uniform force, especially as far as track, bridge and building, water service and signal gangs are concerned; all that is required is to eliminate for one year the monthly comparisons of net earnings with the corresponding months of the previous year and to inaugurate a thorough program of work throughout the year with the object of maintaining uniform forces among the various groups referred to above. Also, much of the extra-gang work that is now confined to the summer months, can be performed in the winter. This would tend to keep the same number of men in extra gangs through the year.

The great strides that have been made in the introduction of mechanical equipment since the World War, have reduced the labor requirements of the railroads to such an extent that there is now no reason why the forces now required in the regular organizations should not be given the advantage of continuous employment. If this were done, it would have the effect of putting all of this force in a position to lay up something for old age or sickness, and in addition, it would cause them to value their jobs and try to hold them.

A Graduated Wage Scale

If, in addition to an arrangement for steady and permanent employment, a graduated scale of wages for trackmen could be inaugurated, so that when a new man unfamiliar with the work is employed, he would receive a lower wage than the average, while the men older in years of employment, could receive a bigger wage than the average, we would have an ideal arrangement, as there would be an advancement in wages with longer service which would provide an inducement for men to remain in the service. Under the present plan, with a flat wage paid to all trackmen regardless of their skill or familiarity with the work, there is no inducement but seniority to encourage trackmen to give continuous and dependable service. In the bridge and building, water service and signal gangs there is, of course, a variation in wages for different men in the gang.

Unfortunately, trackmen have always been classed as common laborers, no change being made as track work has become more complicated with the advent of tie plates, anti-creepers, ballast, etc., and with the introduction of various mechanical devices such as track jacks, lining and tamping machines, etc.

The employees are the main stay in maintaining and operating a railroad, and their welfare should be one of the first considerations of a railroad management. If you can keep them happy and contented, you will go a long way toward obtaining economical and efficient operation, as the men will be interested in the success of their company.

The first step toward continuous employment, for 90 per cent of the railroad employees, is a movement to get the investors in railroad stocks to understand that such a movement will mean that for one year the net earnings of the railroads will not be comparable, month by month, with those of the previous year, but will result in a decrease in net earnings during the winter months, followed by an increase in net earnings for most of the other months. On western railroads this will mean an increase, particularly, for the months of July to November, inclusive.

A 300-Day Working Year Should Be Provided

My idea is that a 300-day working year should be the object in view. If this can be brought about, it will mean that these men will be in a position to plan their expenditures and save something each year to provide for sickness and for old age. If the employees of our railroads could save 33 1/3 cents for each of the 300 working days per year, they would accumulate $100 per year. If this were invested in one share of six per cent stock of their railroad, and the earnings applied to the purchase of more shares, a man starting in at the age of 20 and working continually until he reached a retiring age of 70 years would, upon retirement, have an annual income of over $100 per month. If this plan were carried out by two-thirds of the railroad employees, they and their families (if they kept the stock that they purchased), would at the end of 50 years own a majority of the stock of all the railroads of the country. This would mean that they would be represented on the boards of directors within 10 to 15 years and would by the end of 50 years *control* the railroads on which they were employed. This would be an ideal situation. Employees' stock ownership and control are being gradually worked out in some of our large industries and there is no reason why this cannot be successfully effected in the railroad industry, which is the greatest industrial enterprise in the country.

Labor Reductions Made

It is interesting, in connection with a study of the savings made possible by the use of mechanical devices, to see what has been done in the way of reducing the number of employees required during the last 20 years. On the Rock Island, the number of employees has been as follows:

In 1907 there were 38,250 employees
In 1915 there were 37,973 employees
In 1923 there were 37,283 employees
In 1927 there were 36,658 employees

This indicates a reduction in the 20 years between 1907 and 1927, of 1,592 employees, with an increase of 272 miles of railroad operated and an increase of 97 per cent in freight business. This has occurred, notwithstanding the fact that since 1913 there has been a decided increase in the accounting department employees because of railroad valuation and the necessity for making numerous annual reports in connection therewith.

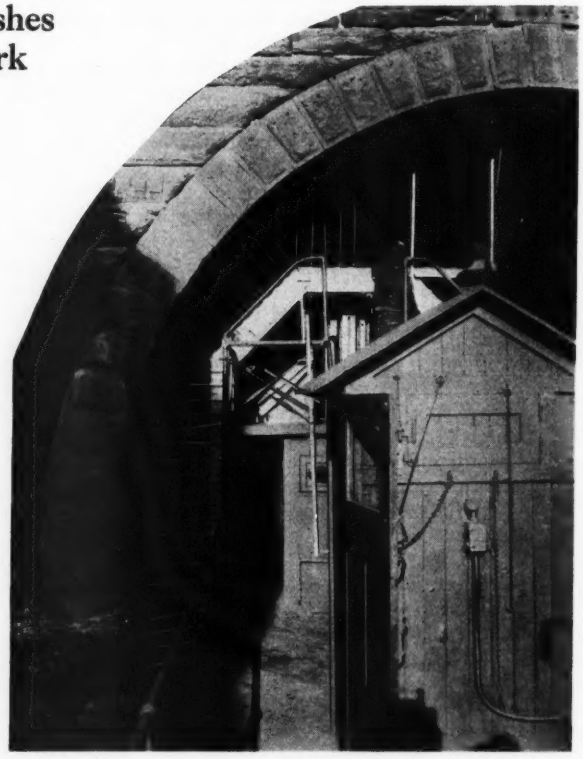
The introduction of mechanical devices has been especially large since 1921 and 1922. The effect of this is shown by comparing the decreases in the number of employees per year for different periods. Between 1907 and 1915 the average decrease was 31 employees per year; between 1915 and 1923 it was 86 employees per year, while for the period between 1923 and 1927, inclusive, it averaged 125 employees per year.

How the Pennsylvania Knows

A Specially Designed Car Establishes the Contour of All Objects. Work Demands Co-operation of Maintenance Organization

WITH the tendency to increase the size of every class of rolling stock, and the increasing demand being made upon the railways to handle shipments of almost prohibitive size, two specific duties of the engineering departments of the railways, heretofore of relatively little importance, have become of primary importance: To know the clearances over every foot of their lines, and to prevent further clearance restrictions by either construction or maintenance work. Both of these are obligations of no small magnitude, particularly on those lines which traverse or enter well-established or congested sections of the country.

Among the considerations contributing to the importance of these duties, safety and increased service are of first rank. The first of these includes safety to passengers, to the railway personnel, to shipments, and to all railway structures, while the second involves the handling of loads of maximum dimensions, and the ability to advise shippers promptly regarding these maximum dimensions and the routes over which shipments of excessive size can move.



Measuring the Clearances in a Double-Track Tunnel

A Pioneer in Organized Clearance Work

Among the roads which have given this matter attention in the past, one of the outstanding is the Pennsylvania. As early as 1908, that road, believing that the future would bring larger cars, larger locomotives and larger shipments on open cars, began the work of collecting clearance data more carefully and accurately. In that year it constructed a specially designed car to be used solely for the purpose of measuring accurately the distance to every possible interfering object above or along side the track. Each part of the car was worked out in detail and constructed along original lines, even the trucks being of a special pattern, entirely different from those in general use on the Pennsylvania. The car itself was built with a steel underframe, and its principal features included a fixed and a movable templet from which all clearance measurements can be made, and two gages for indicating the degree and superelevation of all curves.

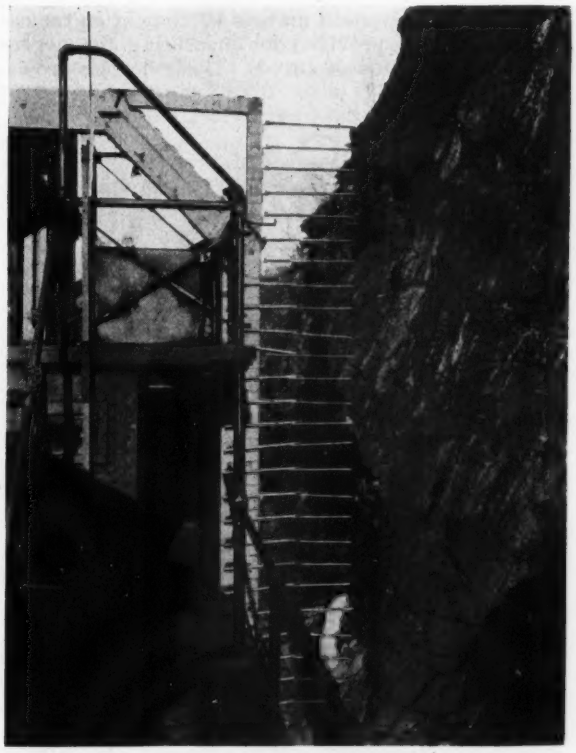
Since its completion, the car has covered every running track on the Pennsylvania, measuring the distances from the various tracks to every bridge, tunnel, station shelter, inter-track fence, bridge abutment and overhead wire crossing, and in fact, to everything within seven feet one inch each side of the center line of the track, between the limits of 3 in. and 20 ft. 1 in. above the top of the rail. In addition, the car has made runs over the lines of foreign roads to Boston and Springfield, Mass.; Providence, R. I.; Richmond and Norfolk, Va.; Atlanta, Ga.; and Birmingham, Ala.; and altogether, has traveled more than 70,000 miles. Throughout all of the actual work with this car it has been run in a special train consisting of a locomotive, the clearance car, and a business car especially fitted to afford office and sleeping and dining accommodations for the clearance car operators.

Car Has Many Interesting Features

Although built 20 years ago, the clearance car remains substantially the same today in every detail of construction. The car itself is essentially a steel-frame flat car with specially designed narrow truck frames, and is fitted with side steps at each end and pipe railings on all four sides to insure safety to the operators while the car is in motion.

The principal piece of equipment on the car is a rigid templet, mounted directly over the forward trucks, from which most of the measurements are made. This templet, which is made up of steel I-beams, straddles the car floor at right angles to its longitudinal axis, and from its lowest point on each side, which is three inches above the top of rail, up to a height of 12 ft. above the top of rail, is exactly 10 ft. wide. Above this 12-ft. height, owing to the size of the smallest tunnels on the road in 1908, when the car was built, the sides of the templet extend upward and inward at an agle of 45 deg. to a horizontal top piece at a height of 15 ft. above the top of rail. This particular height of templet was selected because it is about the maximum height which can be moved without detour or restrictions over all parts of the Pennsylvania, as well as many other roads. An interesting fact in this connection is that the largest passenger cars, Pullmans and express cars

and Maintains Clearances



Measuring the Distances to Projecting Rocks in a Deep Cut

are within a fraction of an inch of 10 ft. wide and slightly less than 15 ft. high over their ventilators, while locomotives seldom exceed 15 ft. in height by more than an inch over the stack, steam dome, bell and cab roof.

The templet, which is painted white and marked to indicate every three inches of its height up to 12 ft., has 79 extending rods, called "feelers," around its outer periphery, which serve to indicate the exact position, with respect to the track, of all objects with which they come in contact. These feelers, which are ½ in. thick, 1 in. wide and 25 in. long, are of wood, and are located at six inch intervals up both sides and across the sloping horizontal top pieces of the templet. Each of these feelers operates on a pivoted connection at its end adjoining the templet, and moves in a plane perpendicular to the plane of the surface of the templet to which it is connected. Thus, for example, the feelers on the vertical sides of the templet operate in a horizontal plane.

Direct Measuring Device Facilitates Recording

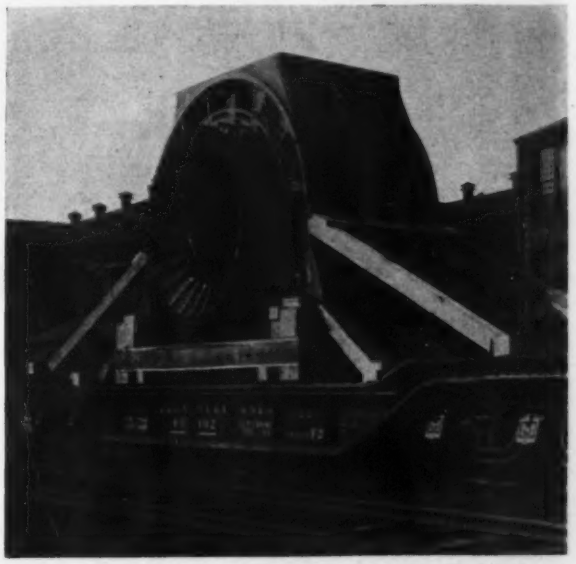
In the specific type of pivot joint for each feeler, the feeler stick is fastened to one leg of a small brass angle by a bolt and a thumb nut, the other leg of the angle fitting into a slotted socket fitted to the templet. In order that each feeler will operate about its pivot with a certain degree of stiffness, thereby preventing its movement by vibration, or its excess movement when it comes in contact with an object, each bolt and thumb-nut assembly is fitted with a washer and a spring clip. From the above it is apparent that when the templet is dressed with its feelers, it has the appearance of a large comb, the teeth of which are free to move backward when they come in contact with obstructions.

While the feelers are a most important part of the clearance-measuring equipment in determining the contour of an object or surface with which they come in contact, one of the most desirable and effective features of the equipment is the direct measuring device which makes it possible, by a simple reading at each feeler, to determine the distance of its projecting end from the edge of the templet. This device is based upon the principle of the pantograph, and consists of a specially graduated rule which has a pivoted attachment near the center of the feeler at one end, and slides through an indicator guide, attached to the side of the templet, at the other end. In this arrangement the graduated rule slides inward through the guide as the projecting end of the feeler is moved in by an object, and the rule is so calibrated that a reading opposite the pointer on the guide casting gives directly the distance in inches of the end of the feeler from the edge of the templet.

As each of the feelers is equipped with one of these rules, it is evident, that after the horizontal feelers have been moved backward by coming in contact with an object, it is only a matter of taking a reading at each feeler and adding half the width of the templet (5 ft.) to each reading, to secure the exact distances from the center-line of the track to the nearest points of the encroaching object encountered. This same principle applies to overhead obstructions, the direct readings giving the distance at each feeler, from the object to the edge of the templet.

Adjustment of the Templet Shape Meets Special Conditions

While the templet, as described, is the form in which it is generally used in tunnel work, it should be noted that, for measuring the distances to perpendicular objects of considerable height and close to the track, such as rocks in a deep and narrow cut,

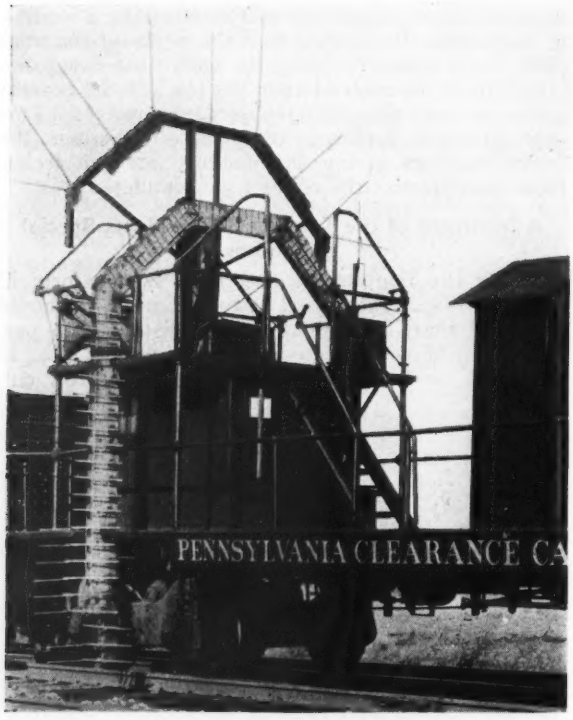


One of the 2,500 Special Clearance Problems Which the Pennsylvania Handles Each Month

the trusses of through truss bridges, buildings, poles, abutments, etc., the beveled upper corners of the templet can be changed to form square corners, making the templet 10 ft. wide throughout its entire height of 15 ft. This is possible since one-half of each beveled section of the templet is so built and hinged, that when it is lifted from the bottom end, the other half of the beveled portion drops into a vertical position and rests on the top of the main upright of the templet at the 12 ft. height. This vertical piece, like the other parts of the templet, can be dressed with feelers, and any object closer than 25 ft. will swing them backward until their tips scrape past.

The only other special feature of the main templet is the hinged sections, about 21 in. long, which form the lower parts of the templet. These sections were provided with a hinged connection to the rigid part of the templet so that they can be raised clear of obstructions near the track when the train or car is making a non-stop run. It was to make it possible to provide these lower sections of the templet and to permit their being observed readily by the operators, that special narrow truck frames were designed for the car.

In addition to the main templet, a partial templet is also provided on the clearance car for measuring overhead objects of greater height than can be measured by the main templet. The auxiliary templet,



The Auxiliary Templet in a Raised Position

which is similar in outline to the main templet except that it has only two feet of the vertical sides, is located immediately in front of the main templet and is mounted and counterbalanced so that it can be raised and lowered in a vertical plane. This templet was provided because of the fact that many structures on the road were found to be just beyond the limits of the main templet with its 25-in. projecting sticks. In order to reach these structures, the auxiliary templet is arranged so that it can be raised by steps to a point 18 ft. above the top of rail. With provision for 25-in. feelers, spaced six inches apart over the top of this templet, it is possible to measure the height of structures 20 ft. 1 in. above the top of the rails.

Two other important units of equipment on the car are the devices provided for measuring the degree and super-elevation of curves. These devices are es-

Reading and Recording the Measurements as Indicated by the Feelers After Passing Through a Cut

sential because, if any object measured is on a curved track, clearance allowance must be made for the overhang at the center of long cars or shipments. Information for computing the overhang is secured from the curve degree dial, while the reading of the super-elevation dial is used to show how much a specific car or load would lean if stopped or moved slowly around a curve. Both of these dials are located in a small instrument house near the center of the car, the curvature device being operated directly from the rear truck of the car by a system of rods, while the super-elevation measuring device consists essentially of a pendulum, which, when at rest, indicates to within ¼ in. the super-elevation of the outer rail.

Operation of the Clearance Car

Three men handle all of the work in connection with the clearance car. When ready for a run, the special clearance car train is made up and the crew is told to slow down for everything which they think might come in contact with the feelers. At the same time, a clearance car operator stands on each side of the car and keeps a close lookout for places which require measuring.

The first thing to be measured may be a through girder bridge, the girders of which stand up on each side of the track to the height of the floor of the car. When this is approached, the train slows down and all of the sticks on the templet, from six inches up, which will come in contact with the object, are swung outward at right angles to the car. In doing this the operators place a six-foot pole behind the sticks as

they lie parallel with the car, and swing all of the sticks outward at one time. The train proceeds towards the bridge at from four to six miles per hour, and as the extended sticks strike the bridge girders they are swung slowly backward until the tip of each stick scrapes lightly along the bridge, the tension in the pivot bolt keeping the stick from flying backward. While this record is being made, one of the operators notes carefully the exact height of the girders with reference to the height markings on the templet.

After the templet has passed entirely through the bridge, the train is stopped, and from the specially designed graduated rule attached to each of the feelers, the operators can read the exact distances between the outer face of the templet and the closest points of the bridge. These readings are, of course, at each six inches of height, and as the readings are called off by the operators at the sides of the car, the third operator records them on a special clearance form. This form is an 8-in. by 13½-in. sheet, having on it, drawn to scale, an outline of the templet, with lines to indicate the relative position of each feeler stick. After the readings of the feelers are set down on the appropriate lines on the form, the relative distances measured can be platted immediately and connected to give a graphical representation of the outline of the obstruction passed.

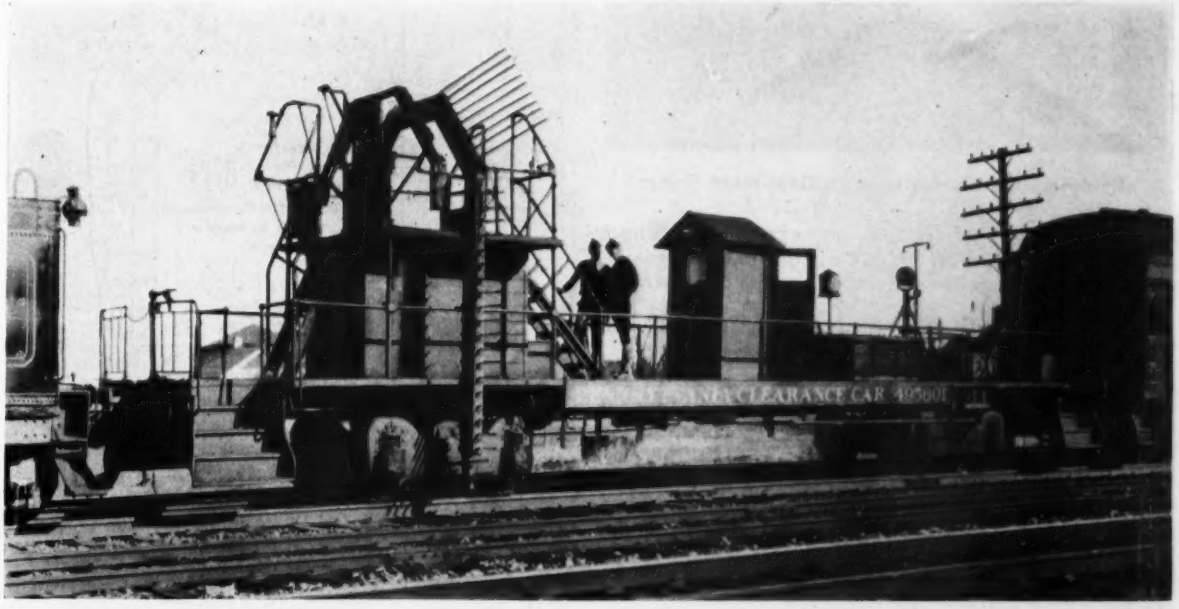
Clearances Are Measured in Rock Cuts

When the record is completed, which usually requires from two to four minutes, the train moves on, only to slow down again within a few miles to measure some other object, when the feelers are again swung out ready to be pushed inward by the protruding object. In ordinary rock cuts, measurements can be made from the templet in its normal shape, but if the rocks extend to a considerable height and are close, the form of the templet is changed to give it a square top and vertical sides with a height of 15 ft. As the cut is traversed, any projecting rocks within 25 in. of the templet swing back the feelers that strike them, until their tips scrape past. Again the train is stopped, and one of the operators, beginning at the topmost stick, calls off to the note-keeper the distance that is indicated by each stick.

At an overhead bridge the side sticks are swung out to record the masonry-work on the side, while the operators confine their attention to the overhead portion, in most cases using a graduated pole to measure the height of the structure over the extreme outside limits of the templet, and, at the same time, watching to see that the upright feelers over the center of the templet, record any projecting portions. They also note what parts move the feelers downward excessively, and whether these parts can be removed if they are very much lower than the main portion of the bridge.

Flood Lights Are Provided for Tunnel and Night Work

Measuring tunnels presents no unusual difficulties other than the smoke and heat that are usually encountered. Darkness offers no problems, for the car is equipped with flood lights suitably located to illuminate the working parts. In all, there are five such lights. Two large lights mounted on standards at the rear of the car and a small light mounted on the top of the instrument house in the center of the car completely illuminate the templet above the car floor, while two smaller lights below the car floor, one on each side, illuminate the lower portions of the templet.

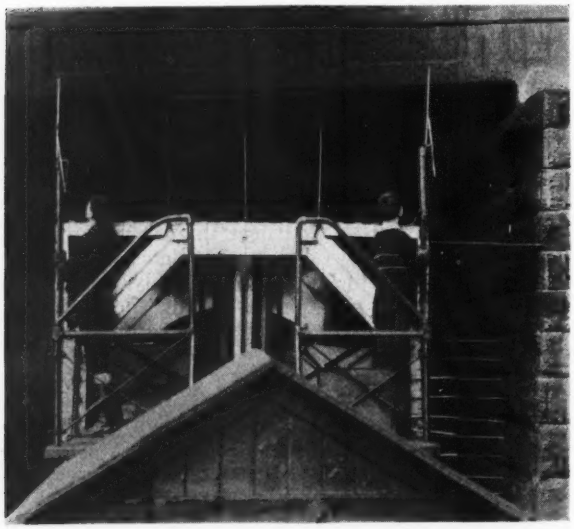


The Pennsylvania's Clearance Car Which Has Recorded the Clearances Over 70,000 Miles of Tracks

In double-track tunnels all of the sticks up one side and over the top of the templet are brought into action. While the sticks scrape the tunnel walls and a part of the roof, the operators, using graduated poles, measure the distances to the higher portions of the roof over the side of the templet away from the wall.

Under most conditions, in measuring clearances with the car, the operators watch the feelers so that they can make note of any projections which may extend out unusually far and thereby become ruling points in the clearance offered. If for any reason

they have not been able to watch the feelers in passing an obstruction or series of obstructions, and they find that a certain few of the feelers have been pushed inward considerably more than the others, the only way by which they can determine just what object or portion of an object encroaches so prominently, and the exact location of the object, is to run back over the section of track. This may be done in either a forward or reverse movement as the car is adapted for operation in both directions. Sometimes a check



Recording the Clearances at an Over-Head Bridge

run over a piece of track is important, for a single projection, which can be cut off or removed easily, may be the determining clearance over a long stretch of line.

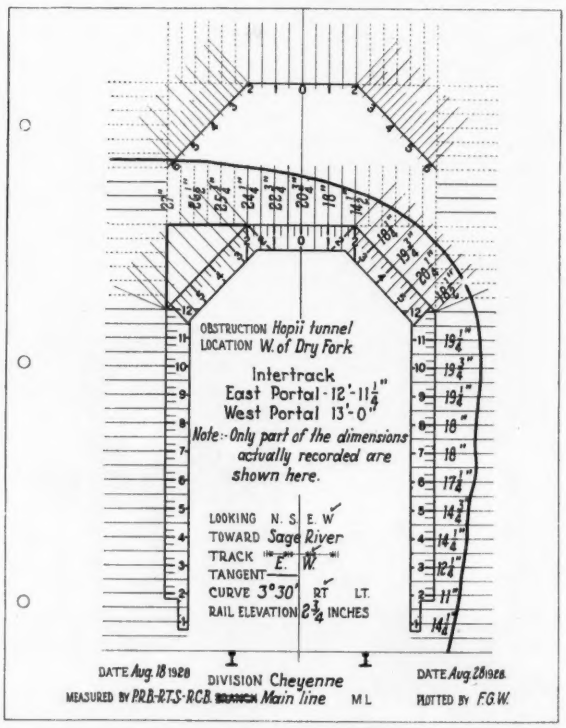
In running back over a piece of track immediately, or at some later time, to locate the point or points of closest clearance, the practice followed is to set the feelers according to the measurements taken on that particular piece of track, and then to watch those which indicate the tightest place. Naturally the feelers will clear all objects by a wide margin, excepting those which indicate the ruling clearance. When these latter points are reached, note is made of the interfering object and its location, and consideration is given as to whether it can be removed or set back.

Clearance Records Are Carefully Made and Maintained

Following the procedure outlined, the clearance car has covered every main and branch line on the Pennsylvania, all sidings, all leads and running tracks in yards, and in addition, a large number of private and industry tracks served by that road. In all of this work three men have formed the clearance car crew, two men from the office of the clearance engineer and one man from the office of one of the regional engineers maintenance of way. This third man from the region office has been generally the man who handles clearance matters on the region, and he has accompanied the car so as to be thoroughly familiar with the records made in his region.

In order that the data collected may be made available as soon as possible, the field notes are sent to draftsmen in the main office of the Pennsylvania at Philadelphia, who plat to a scale of one-half inch to the foot, the outline of every structure or object measured, combining on one sheet or drawing everything that has been measured between any two junction points; a separate sheet being prepared for each track wherever there are two or more tracks in the territory covered.

In all cases, three copies of the platted records are made, two of which are sent to the regional engineer maintenance of way, who, in turn, keeps one copy and sends the other copy to the division engineer concerned, while the third copy of the record is retained by the clearance engineer. In this way, the clearance engineer keeps his record up to date, the engineers maintenance of way are kept informed of conditions on their regions, and the division engineers are given a definite record which enables their track, bridge and building and signal supervisors to ascer-



The Field Note Form as Filled in by the Car Operators After Passing Through a Tunnel

tain the points of closest clearance on their territories with the view of remedying adverse conditions. In this way, as clearance measurements have been completed over the road, clearance conditions have been gradually improved, and a complete office record has been compiled and so arranged that it is possible, when necessary, to tell over what route, and on what track, there is the greatest clearance for any particular load.

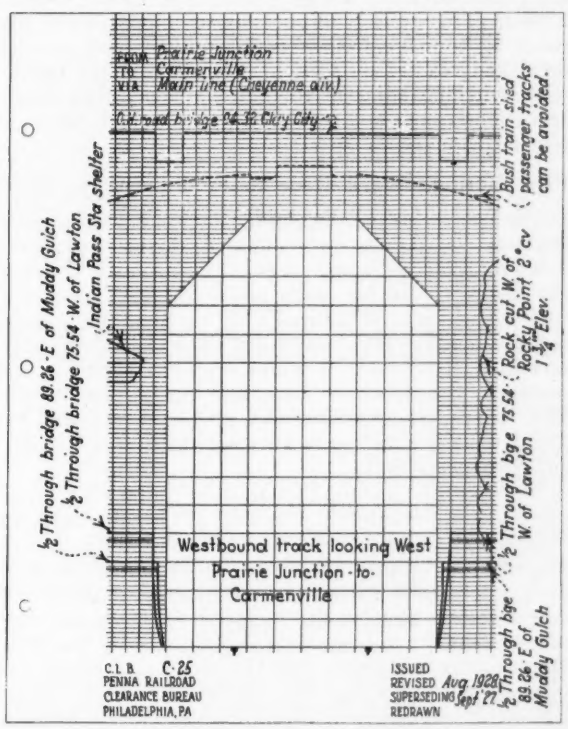
Maintaining Established Clearances

Keeping these records accurate and up to date is part of the principal work of the clearance car and the clearance department, or bureau. While the main problem in this respect is to determine the clearance of newly erected structures of whatever character, the remeasuring of existing structures which may have been rebuilt or altered to offer better clearance, and the constant rechecking of the clearances at points of minimum clearance when these points are passed in making a run, it is no small problem to keep check on the roadway department to see that the raising or

realinement of track does not completely alter existing clearance records. This latter phase of the problem has become less serious as track foremen have become better acquainted with the seriousness of altering established clearances, and also since permanent grade stakes, to guide the foremen, have been placed at many structures where the closest clearance prevails. The work of the clearance bureau has also become less difficult with the closer cooperation of the construction and maintenance of way departments, both of which make it a practice to advise the clearance bureau of all new construction and alterations which affect existing clearances. However, the fact that there is still a large amount of outside work being done by the bureau in maintaining accurate records, is evident from the fact that the clearance car was run over 10,000 miles of lines in 1927, and has already covered over 8,000 miles of lines this year.

Clearance Data Are Invaluable to Shipper

As a result of the clearance work on the Pennsylvania, if a manufacturer wishes to bid on some unusually large piece of machinery or equipment to be


FROM Prairie Junction
TO Carmenville
VIA Main line (Cheyenne div)
½ Through bridge 88.26 E of Muddy Gulch
½ Through bridge 75.54 W of Lawton
Indian Pass Sta shelter
Bush train shed
passenger tracks can be avoided.
Rock cut W of Rocky Point 2°cv 1¾ Elev.
½ Through bge 75.54 W of Lawton
½ Through bge 88.26 E of Muddy Gulch
Westbound track looking West
Prairie Junction to Carmenville
C.L.B. C-25
PENNA RAILROAD
CLEARANCE BUREAU
PHILADELPHIA, PA
ISSUED
REVISED Aug 1928
SUPERSEDING Sept '27
REDRAWN

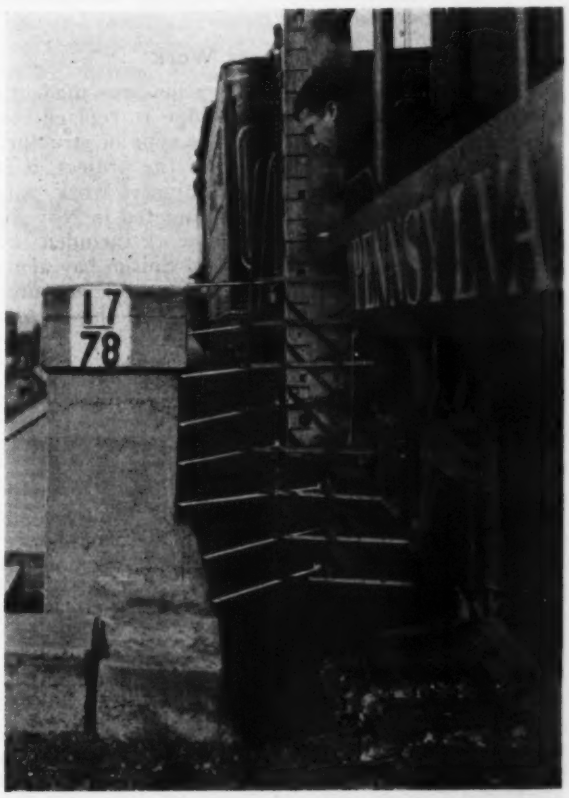
A Typical Clearance Chart, Showing the Distances from the Track to the Controlling Objects in the Territory Covered

built at one point on the road for shipment to any other point on the road, or to be received via the Pennsylvania, the clearance bureau is able to advise him promptly the extreme height and the greatest width which can be moved safely between the points in question. That such cases arise and mean additional business to the Pennsylvania, is shown by the fact that at the present time over 2,500 special cases are being handled safely each month by making use of the information developed by the clearance car.

The consideration which is given to this class of business offered is illustrated, for example, by the fact that if the lading on two cars in a total of five cars offered should be too large for movement via normal routes, the matter is referred to and checked by the clearance bureau, which endeavors to set up a detour route for the two large carloads. As a result of checking the dimensions of the large loads against the clearance diagrams on file, the acceptance of the five cars is authorized, three of the cars to move via the normal route and two by detour.

In order that other departments of the road, and also the public shall have this clearance information in usable form, there is compiled and published from the clearance diagrams, a tabulation of figures giving the clearance data for all through or local routes, and also for sections of these routes between junction points. This compilation shows in figures a width and height that can be moved safely via normal routes from point to point, the tabulation beginning six inches above the top of the rail and stating the permitted width for each three inches of height up to 20 ft. All shipments having dimensions greater than those tabulated are referred to the clearance bureau for special routing.

The results of the operation of the clearance car have always been constructive, and, of first importance, have meant greater service to shippers, greater safety, and more business for the Pennsylvania. All of the work of the clearance car since it was first put in operation in 1908, has been under the direct supervision of Alexander Whilldin, clearance engineer of



Measuring the Distances to a Through Girder Bridge

the Pennsylvania; in fact, the actual design and construction of the clearance car were carried out under his direction. We are indebted to Mr. Whilldin and to the Mutual Magazine for the information contained in this article, this article having been adapted from an article by Mr. Whilldin which appeared in that publication.

Locating Southern Pacific Bridge Across Suisun Bay*

Conditions at the Bridge Site Call for Extreme Care in Determining Nature and Depth of Foundation

By H. I. BENJAMIN
Assistant Engineer of Bridges, Southern Pacific, San Francisco, Cal.

SINCE 1879, the Southern Pacific has used a train-ferry to transfer both passenger and freight trains across Carquinez strait, a distance of one mile, between Port Costa, Cal., and Benicia, about 34 miles east of San Francisco, on the double-track transcontinental line between San Francisco and points east and north. The traffic on this line has increased to such an extent that this train ferry has become a "bottle neck," not only slowing up traffic, but necessitating the routing of many freight trains over longer and less favorable lines. Strong tides and foggy weather frequently delay the transfer movements, making it difficult to maintain schedules, although, in the 49 years the ferry service has been in operation, there has never been an accident to any train on the ferries at this crossing.

The Preliminary Work

For these reasons, an investigation was made to determine the feasibility of a bridge to replace the train-ferry, and to decide upon the type of structure to be used, as well as the cost of the project, if it was found feasible. The preliminary work was started in June, 1927, and was completed in November of the same year. The field work included the making of soundings and borings in Suisun bay along the center line of the bridge crossing to determine the depth of the water, the character of the bottom and the depth to rock.

The survey for location presented no especial difficulties or problems. The United States War Department regulations demand a minimum vertical clearance of 70 ft. from the underpart of steel to mean high water. This required the track to be raised some 74 ft. higher than the takeoff from the present main lines on each side of the bridge crossing. The location selected for the bridge is a natural bridge site extending between two bluffs projecting into the bay and affording support for the roadbed at each approach.

No Geological Faults Were Found in Underlying Rock

The location of the bridge is in territory subject to seismological disturbances and, as the country adjacent to the bridge site has numerous earthquake faults, it is important that none of these faults, live or dead, cross this site. Investigation showed that none of them crossed the center line of the bridge, the result being a location with the greatest possible safeguard against seismological movement. It is interesting to note that the same age fossils were found in the rock at each approach, as well as in the core from each diamond drill boring, showing conclusively that the rock underlying the bridge crossing is of the same age.

The approaches at each end of the bridge site were located so that the grade lines and alinement would be consistent with tonnage train operation. At the south, or Martinez approach, a 1 per cent grade was established, this being necessary on account of the prohibitive cost of constructing a low grade line because of existing street crossings in Martinez, overhead tramways and a highly developed industrial situation. This grade will necessitate helper service for the long tonnage freight trains only, which can be furnished readily by switch engines used for industrial switching adjacent to the approach. The north approach is on a 0.45 per cent grade, which will not restrict tonnage or speed.

First Borings Were Made to Find Depth to Rock

The center line of the bridge crossing having been selected, the borings were located thereon to establish average conditions, no effort being made to have the borings coincide with piers, because, until the rock depth was determined, a preliminary design would obviously be guesswork. The holes bored determined the depth of water, the character of the material, the depth to rock and the nature of the rock, which, when plotted on a profile, determined the approximate conditions at any pier location sufficiently for purposes of design.

The bridge crossing, from face to face of abutments, is approximately one and one-eighth miles in length. The Government pierhead and bulkhead lines permit steel viaduct approaches to be constructed on each side where the water is extremely shallow and where rock is close to the surface. A 300-ft. Government channel has been located definitely by the War Department engineers, and the channel dredged for ocean going vessels. These facts narrowed down the necessary investigation so that, when borings were made, only seven holes were found necessary to determine the material below the mud line. In addition to this, test piles were driven south of the Government channel to locate the surface of the rock in that vicinity.

On account of the great tidal range and swift currents, it was deemed advisable to construct pile platforms to support the drill machines, rather than to use anchored barges, which latter might have resulted in the loss of holes and valuable drilling machinery.

A structural-steel built-up cage, approximately two feet square, bolted together in sectional lengths and containing a funnel-shaped guide every 8 ft., was lowered in the exact center by the floating pile driver, and was driven approximately 10 ft. into the mud. The top of the cage was a few feet below the platform floor, and the cage, which was braced to the

*Abstracted from a paper read before the Annual Convention of the American Railway Bridge and Building Association at Boston, Mass., on October 23.

two adjacent bents, served its purpose successfully as a stiffener for the 10-in. well casing which was later driven to rock and which was exposed to tidal pressures in deep water, tending to bend it.

The initial drilling was performed by a standard well-boring rig through a double-thickness 10-in. well casing, which was applied in 4-ft. lengths, the inner and outer shells overlapping and being riveted by hand. The bottom section of the casing had a special reinforced cutting edge. The sand pumps enabled very complete data to be assembled as to the nature of the material above the rock. Bearing tests were made on the strata of compacted sand, pea gravel and sand, gravel, and soft and hard shale overlying the rock and developed that there was not suitable material above the rock line upon which to found the pier.

After the top of the rock had been located, the surface was chopped and cleaned, and a diamond drill was set up, the cores disclosing the characteristics of the bed rock encountered. The core samples were placed in core boxes, with elevations noted and kept for future reference. In addition to the holes bored, two test piles were driven on the south side by the pile driver to locate the surface of the rock, which was known to be not very far below the surface of the water.

The deepest water encountered from mean high water to the top of the mud line was 62 ft. at the north end and the greatest thickness of material overlying the rock was 103 ft. This material consisted mainly of mud, blue clay, sand and some gravel immediately overlying the rock. The borings established the fact that a suitable foundation rock exists at a reasonable depth and that bridge piers may be successfully constructed along the selected bridge site. Several of these piers will be sunk by the pneumatic process, but for those in deeper water the open dredging method will be employed.

Average Depth to Rock Is 120 Ft. Below Water

The rock upon which the piers will be founded is of the Chico formation, very heavily bedded and tilted at an angle of 45 deg. The rock is excellent for the purpose and its average depth, where the main piers will be located, is 120 ft. below low water. The greatest depth of rock below water is 140 ft. The piers, extending 70 ft. out of the water, will have a total height of approximately 210 ft., or about the height of a 21-story building. There will be approximately 15,000 cu. yd. of concrete in each pier and the weight will be 30,000,000 lb. Where the rock is found to be 90 ft. or less below the tide level, the pneumatic process will be used in the construction. This will have the advantage of determining accurately the formation upon which the pier will rest. Where the rock, however, is over 90 ft. below water level, the piers will be constructed by the open dredging method. Previous to the actual sinking of the caissons, two additional borings will be made to determine the slope of the rock formation, and after the caissons have been sunk the bottom will be shot, if necessary, to secure the proper level for the foundation. The design for the piers calls for six dredging wells, which, after the cassons have been sunk, the wells excavated and the top of foundation bed cleaned, will be filled with concrete, using a large metal bucket for the filling operations.

Railroads Announce Prize Awards

THIS IS a season when annual track inspections are conducted and data are obtained which serve as the basis for the award of prizes for excellence in track maintenance. Up to the time of going to press, information had been received from three roads covering the awards made by them, namely: Three regions of the Pennsylvania, the Long Island and the Norfolk & Western, which are outlined in detail below:

Norfolk & Western Awards 85 Prizes to Section Foremen

Following the annual track inspection on the Norfolk & Western, a total of $2,190 in cash awards was made to 85 section foremen. In each case the prizes were awarded as a result of thorough inspections by committees composed of section foremen and roadmasters, who adjudged each section on the following seven points: Line and surface, frogs and switches, ditches and roadbed, right-of-way, station grounds, fences, and road crossings. Each of these classes of maintenance work was rated separately, and a total rating of ten was considered perfect. In determining the winners, the ratings established by the committees of roadmasters were the only ones considered, the reports of committees composed of section foremen being used for comparative purposes only. Four prizes were awarded on each roadmaster's subdivision, ranging from $40 for the first prize to $10 for the fourth prize.

As a result of the inspection this year, the three highest ratings were given to section foremen on the Pocahontas division. The highest rating of 9.47 was awarded to A. C. Davis, section No. 3, on roadmaster's division No. 14. The second highest rating of 9.41 was given to two foremen; J. F. Rose, section No. 10, roadmaster's division No. 12, and Sam Jones, section No. 17, roadmaster's division No. 12-A. The division receiving the highest rating for the year was that composed of the Roanoke terminals, which also received the highest rating in 1927. Its average rating for this year was 9.24, while its average in 1927 was 9.22. The second highest division rating of 9.17 was given to the Pocahontas division. The general average for all divisions was 9.03, as compared with 9.04 last year.

Pennsylvania Eastern Region Makes Big Event of Inspection

Following a practice started back in 1873, of the general manager's annual track inspection a gala event was again made on the Eastern region of the Pennsylvania. For two full days, the general manager's party, which included about 135 supervisors, assistant supervisors, division engineers, superintendents and general superintendents, rode over the main lines of the Eastern region in two special trains equipped with four inspection cars. At the end of this inspection, which supplemented periodic inspections throughout the year by a committee of operating officers, the general manager announced the winners

of the annual track prizes for 1928, which amounted to a total of $5,400.

The largest prize, known as the "Klondike" prize, which is awarded to the main line supervisor's territory maintaining the best line and surface throughout the year, was won by N. R. Hunter, supervisor, and R. W. Sheffer, assistant supervisor of Subdivision No. 22 of the Philadelphia Terminal division, at West Philadelphia, Pa. Of this prize, which amounts to $1,200, Mr. Hunter was given $800, while the remaining $400 was divided between Mr. Sheffer, the present assistant supervisor on this territory, and E. L. McNeal, at Millville, N. J., who was assistant supervisor of this territory for a considerable part of the year.

The "Improvement" prize, amounting to $1,000, and given to the main line supervisor's territory showing the greatest improvement in line and surface during the year, was awarded to Subdivision No. 3 of the New York division. As a result, $700 of the prize was given to H. W. Anderson, supervisor at New Brunswick, N. J., and the remaining $300 was divided between B. C. Wagner and A. P. Talbot, who have acted as assistant supervisors on this territory during the year.

In addition to the two main prizes mentioned, four additional prizes of $800 were awarded to the supervisors and their assistants maintaining the best line and surface on the main line divisions of the Eastern region, excluding the territory which won the Klondike prize. These prizes, which amounted to $600 for the supervisor and $200 for his assistant supervisor, were awarded as follows: C. O. Long, supervisor, and C. T. Trowbridge, assistant supervisor of Subdivision No. 4 on the New York division, at Trenton, N. J.; R. Woodcock, supervisor, and D. E. Rudilsill, assistant supervisor of Subdivision No. 43 on the Middle division, at Lewistown Junction, Pa.; J. F. Swenson, supervisor, and H. D. Kruggel, assistant supervisor of Subdivision No. 32 on the Philadelphia division, at Lancaster, Pa.; and W. T. Bevan, supervisor, and L. B. Curtis, assistant supervisor of Subdivision No. 83 on the Maryland division, at Perryville, Md.

Sixteen Awards Made on Central Region of the Pennsylvania

Following periodical inspections made by a committee of operating officers over the central region of the Pennsylvania, 16 cash prize awards have been made to main-line and branch-line supervisors, who, in the judgment of the committee, maintained the best sub-divisions throughout the year. The highest prize award for the region, which amounts to $800, was given to C. W. Van Nort, supervisor on Subdivision 10½ of the Pittsburgh division, with headquarters at Johnstown, Pa., and carried with it a prize of $400 for the assistant supervisor of the same subdivision, G. M. Sauvain. For the best line and surface maintained on other main line divisions, cash prizes of $600 each were awarded to D. E. Callahan, supervisor on Subdivision 1 of the Eastern division, with headquarters at Pittsburgh, Pa., and to R. L. Chaney, supervisor on Subdivision 4 of the Panhandle division, at Dennison, Ohio; a cash award of $200 was also made to F. W. Kittelberger, assistant supervisor on Subdivision 4 of the Panhandle division. In order to stimulate the improvement in the physical condition of the various subdivisions from year to year, a new prize of $700 was posted for 1928, to be given to the main line subdivision which had shown the greatest improvement during the year. This prize was awarded to H. R. Geib, supervisor on Subdivision 1 of the Panhandle division with headquarters at Carnegie, Pa.

In addition to the prizes mentioned, ten other prizes of $100 each were awarded to the following branch line supervisors: M. J. Bray, on the Akron division, at Orrville, Ohio; R. D. Burns, on the Buffalo division, at East Aurora, N. Y.; F. G. Church, on the Pittsburgh division, at Pittsburgh, Pa.; W. P. Critchfield, on the Conemaugh division, at Blairsville, Pa.; E. W. Durben, on the Cleveland division, at Cambridge, Ohio; C. H. Frick, on the Allegheny division, at Kittanning, Pa.; T. L. Hofmeister, on the Erie & Ashtabula division at Ashtabula, Ohio; E. W. McGarvey, on the Monongahela division, at Uniontown, Pa.; I. S. Pringle, on the Renova division, at Emporium, Pa.; and C. P. Sipe, on the Wheeling division, at Steubenville, Ohio.

Pennsylvania Western Region

In the Western region of the Pennsylvania, Barney J. Boyle, supervisor on the St. Louis division, with headquarters at Terre Haute, Ind., received the first prize of $800 for the subdivision having the best line and surface. Patrick O'Connor, supervisor on the Toledo division, with headquarters at Upper Sandusky, Ohio, received the improvement prize of $700 for the subdivision showing the greatest improvement in line and surface during the year. In addition to the above, four prizes of $600 each were awarded to supervisors whose subdivisions were judged to have the best line and surface on each of four divisions. The prize on the Columbus division was awarded to Delphi Lewis, with headquarters at Richmond, Ind., Mr. Lewis being the winner of the region prize last year. The prize on the Ft. Wayne division was awarded to C. R. Light of Warsaw, Ind. On the Logansport division it was awarded to Chas. McCarthy, supervisor at Union City, Ind., and on the Cincinnati division to T. Binkley, Jr., supervisor at Xenia, Ohio.

Thirteen Received Awards on the Long Island

Continuing the annual custom of distributing cash prizes to its supervisory officers whose divisions and sections have been judged to be the best maintained throughout the year by a special "Marking Committee" which makes bi-monthly track inspections, the Long Island divided a total sum of $1,150 among 3 track supervisors and 10 section foremen. The awards this year were made following the first general inspection of the newly created New York zone of the Pennsylvania, which comprises the Trenton and New York divisions of the Pennsylvania, and the Long Island.

For the fourth consecutive year, Ralph L. Haring, supervisor of Division 2, with headquarters at Jamaica, L. I., was awarded the "Klondike" prize of $200, for having maintained the best line and surface on his tracks. The second highest prize, which amounts to $100, was awarded to C. R. Gerard, supervisor of Division 3, with headquarters at Jamaica, L. I., while a special prize of $100 was awarded to Lee Spencer, supervisor of Division 1, with headquarters at Long Island City, whose division showed the greatest improvement during the year. The remaining $750 was divided among ten section foremen in first and second prizes of $100 and $50 respectively, who made the best showing on their respective divisions.

What's the Answer?

What Our Readers Have to Say on Current Questions That Perplex Those Engaged in Maintaining Tracks, Structures and Water Supply Facilities

QUESTIONS TO BE ANSWERED IN THE FEBRUARY ISSUE

1. *What special attention should be given in the late winter months to rail which has been laid earlier in the winter?*

2. *What are the relative merits of the various methods of fastening guard timbers to the ties on bridges?*

3. *What is the best method of providing drainage around turnouts in a ladder track in a flat yard? How can this best be done when it is not feasible to provide a complete underground drainage system?*

4. *What is the best method of preserving brick walls which have begun to disintegrate on account of exposure to the weather?*

5. *What are the relative advantages and disadvantages of air-cooled and water-cooled engines for motor cars under different climatic conditions and for different kinds of service?*

6. *What are the relative merits of a reservoir or an extra water tank for settling turbid waters where the daily requirements do not exceed 100,000 gal?*

7. *What are the qualifications for operators of motor-driven labor-saving devices? What can be done to secure men with the proper qualifications for this class of work?*

8. *What precautions should be taken to insure a bond when encasing members of a steel span with concrete?*

Circulating Systems for Internal Combustion Engines

What troubles may be expected in operating internal combustion engines if a circulating system is not used for cooling?

Engines Are Cooled by Flowing Water

By Engineer Water Service
Western Road

On our internal combustion engines used for pumping, we cool the cylinders by piping water from the discharge line from the pump and allowing it to flow through the jacket and thence back to the well, where well water is used. The only trouble we have with this method is where the water is hard, causing deposits on the cylinder. Ordinarily this can be removed by acid or soda ash, although in some cases it is necessary to have an extra cylinder head on hand for replacement while cleaning the one which has been choked in service, since the greatest scaling takes place in the combustion chamber where the heat is greatest. While this requires some work, it is more economical than to install a mechanically-operated circulating system for the water jacket.

We are rapidly doing away with internal combustion engines in our pumping plants wherever possible by the installation of electric motors. Electric current is now available at many points and even where the rates are high, its use is economical, since it permits the use of automatic control, saving the cost of a pumpman. With this method of operation, the tank is always kept full and this prolongs the life of the tub by arresting decay.

Adequate Circulation Must Be Maintained

By J. P. Hanley
Supervisor Water Service, Illinois Central, Chicago

In operating internal combustion engines, a cooling system of some kind is essential. In smaller engines of the portable or motor-car type, this cooling is sometimes effected by a fan which forces air against "fins" on the exterior of the cylinder. In large engines of the stationary type, the cooling is usually done by water, which may be running water taken from a pressure system, such as the discharge line from the pumps, or water circulated from a small storage tank located near the engine. In the latter case the circulation is often assisted by a small pump, usually of the rotary type, actuated by the engine it cools.

In other cases the circulation is effected by heat. In this method the water, after being warmed in the water jacket around the cylinder, ascends to the top of the tank and is replaced by the cold water from the bottom of the tank, this in turn being replaced by the water as it cools in the tank, the cycle continuing as long as the cylinder is warm enough to heat the water. This is the principle used in hot water heating systems.

Whatever system is used should be capable of keeping up a circulation sufficient to cool the cylin-

der to the desired temperature, otherwise the heat from the explosion of the gases will quickly overheat the piston and cylinder walls, resulting in the loss of viscosity of the lubrication and stopping the engine. If the trouble is discovered soon enough, the damage may sometimes be repaired by removing the cylinder and loosening and lubricating the rings, after which they may be replaced. If the overheating is allowed to continue, the cylinder walls will become warped to such an extent that the cylinder must be rebored or a new one installed, and this, in turn usually requires new over-size piston rings. It is therefore necessary to maintain the circulation in good condition to prevent interruption to service and costly repairs. The type of circulating system used depends on the service demanded of the engine and the amount that can be expended economically to insure its operation.

In our internal combustion engines used in pumping service, we usually cool the engine by water from a pressure pipe which flows over the cylinders, thus keeping a steady supply of cold water. This method works very well in most cases, but where the water is hard and forms incrustations on the cylinder, a circulating system operated by a pump, or one of the thermal type is used.

Location of Plowed Fire Guards

How far from the tracks should fire guards be plowed to be effective?

Depends on Grades and Prevailing Winds

By V. H. Shore
Yard Foreman, Atchison, Topeka & Santa Fe, Dodge City, Kan.

The distance that fire guards should be plowed from track depends on several conditions. This part of the country is subject to high winds, but has not many steep grades. Fires set from locomotives are usually caused by sparks from the smoke stack and sometimes are carried a considerable distance. A locomotive exhausts much harder pulling a heavy train up a steep grade and consequently sparks are thrown higher and are carried farther by the wind. We do not have as much trouble on north and south lines as on east and west lines, as our prevailing winds are from the north or south. In this part of the country, 200 ft. from the track is considered a safe distance.

Must Usually Be Determined by Trial

By Division Engineer

The distance fire guards must be plowed from the track cannot be fixed definitely for any road or even for any one division, since there are so many modifying conditions. The obvious distance is one that will prevent live sparks from the smoke stack of the locomotive from setting fire to the dry vegetation in the fields, but this is hard to define in feet. A distance of from 200 to 250 ft. from the track is usually sufficient, but there are times when this is not enough and the distance for any particular location should be fixed from experience in the past.

It is usually found that certain locomotives cause more grass fires than others and a check of the reports will usually locate these engines without any trouble. When they are located, the mechanical department should examine the netting in the exhaust and put it in good condition to serve its purpose. When I was a roadmaster, we had considerable trouble with a certain engine during a dry summer and could trace its progress over the road by the fire reports received from the section foremen. An examination by the mechanical department showed the netting to be defective, and when it was repaired, the number of fires decreased materially. The section foreman can do much to keep down such fires by giving complete information in his reports so that the worst offenders among the engines can be made known.

Turning Worn Crossing Planks

Is it economical to turn crossing planks when they become uneven through wear?

The Planks Should Not Be Turned

By A. A. Johnson
Track Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

Crossing planks are usually from 3 in. to 4 in. in thickness and when they become worn under traffic to the point where the surface of the crossing is rough, it is undesirable to turn them over and use them in the same class of crossings. Such crossings carry heavy vehicular traffic, including heavy trucks, and planks that have been worn thin in spots are not safe, owing to the fact that they may break under heavy loads. Worn planking can be safely used in sidewalk crossings, minor highway crossings or farm crossings where heavy, high-speed vehicular traffic is not carried.

It Is Not Economical to Turn the Planks

By J. E. Fanning
District Engineer, Illinois Central, Waterloo, Iowa

It is not economical to turn crossing planks when they become uneven through wear on account of the difficulty experienced in obtaining a good bearing underneath. Unless crossing planks have a good bearing, there is a tendency for them to roll under load and become displaced. Another objection to the practice of turning the plank is that when the underside, which has been subjected to moisture, is exposed to the air, deterioration is rapid. It is better practice to remove worn planks from important crossings and use them with the worn side up at farm road crossings where a smooth surface is not so necessary.

Not Usually Economical if Badly Worn

By Assistant Engineer Maintenance of Way

The economy of turning crossing planks depends on a number of different conditions, chief among which are the extent to which the planks are worn, the service life which may be expected from the planks after they are turned, and the refinements which are necessary to secure an even surface to meet the demands of the highway traffic over the crossing. The increasing use of motor vehicles has emphasized the need of smooth crossings, and surfaces which were satisfactory for horse-drawn vehicles now cause complaints from the occupants of automobiles, motor coaches and trucks.

If the planks are badly worn, and especially if they are worn unevenly, it usually does not pay to turn them in a crossing carrying a fairly dense highway traffic, since an excessive amount of work is neces-

sary to adjust the furring to provide a smooth surface. In such cases, it is better to replace the planks with new ones and to use the old planks in less important road crossings or in private crossings where they may be needed. If the planks are sound, it is our practice to use them in this way, or in some other manner, to obtain the longest possible life from the timber. We are making efforts to conserve timber and these planks can often be used satisfactorily in the place of the new ones for various purposes.

When necessary to take up a plank crossing to work on the track, the planks are often turned, if they have become worn, although not to an extent where they will cause complaint. When this is done, it usually requires but little work to level up the crossing, but care must be taken to see that all spikes are removed or driven down so that they will not cause damage to horses or the tires of motor vehicles.

Heating Concrete Aggregates

What are the relative merits of the various methods of heating the aggregates for concrete on large jobs?

Steam Is Usually the Best Method

By W. M. Holm

Railways Bureau, Portland Cement Association, Chicago

On large jobs, steam is generally favored for heating aggregates. It is used at temperatures sufficiently low as not to injure the aggregates and to permit the piles to be kept covered with tarpaulins without danger of fire. The result is the most benefit with the least fuel.

Steam is used in two ways. One is to place a grillage of pipes, either continuous or with manifold coils, near the bottom of the stock pile. The other is to insert perforated pipes with pointed ends into the piles, these pipes concentrated in the particular part of the pile in use at the time. The first method is recommend where a fixed layout is to be used during the entire job, with manifold coils which permit condensation to be drained off more easily. For enclosed storage, hot water coils may be warm enough. Where the work is such that mixers are moved about and many smaller stock piles are needed, the use of perforated points is cheaper, although if concreting is intermittent, frozen condensation can be troublesome. The use of fire in a length of smoke stack should be avoided, if possible, because of the possibility of injury to materials from overheating, although this expedient is often used where there is no extra boiler available.

Under proper handling, winter concreting is safe and has certain marked advantages. It tends to reduce seasonal unemployment and avoids the crowding of all construction work into a brief, hectic period, although because of a number of influences, it is no more expensive, as a rule, than summer work.

Steam Pipes Are Most Satisfactory

By G. A. Haggander

Bridge Engineer, Chicago, Burlington & Quincy, Chicago

We find that steam from an upright boiler, forced through perforated pipes, is the most satisfactory method of heating concrete aggregates for either large or comparatively small jobs, since there is no injury to the materials by this method.

For large jobs, it is our practice to lay a length of perforated pipe, about 2 in. in diameter, on the ground or platform where the aggregates are to be unloaded and to pile them on top of the pipe when unloading them from the cars, thus allowing a number of cars to be unloaded before freezing weather. A bend or return is put in the pipe line at the end of the storage pile farthest from the boiler and the line carried back the entire length, so that there will be two lines furnishing steam for any pile of material.

For the smaller jobs, we use short perforated pipes, which are driven into the piles. This does not require as elaborate a layout as the other method and will heat sufficient material to keep the job going. At night the material over the pipe is covered with a tarpaulin to retain the heat. A large boiler is not required for either of these methods; we find that a 36-in. or 40-in. boiler is ample. We do considerable concrete work in winter and supply the necessary boiler, pipes and fittings to all of our gangs in concrete work during the winter season.

For very small jobs, we have sometimes used salamander under tarpaulins, but do not find that method as satisfactory as the use of steam, since their tendency is to dry out the aggregates, while the steam keeps them moist. We do not favor heating concrete materials by piling them over old boiler shells or metal pipes in which a fire is kept up, as the materials next to the metal are overheated to an injurious degree. I have known of some very bad results where the aggregates were heated in this manner.

Removing Snow from Yards

What is the best method of removing heavy falls of snow from yards?

Spreader Car with Pilot Snow Plow

By W. L. Peoples

Assistant Engineer Maintenance of Way and Structures, Wheeling & Lake Erie, Brewster, Ohio

A spreader car equipped with a pilot snow plow can be used to good advantage by the following method: Select pairs of tracks equally spaced throughout the yard and utilize these for the storage of snow. Operate the spreader car from both left and right, piling the snow high. In this manner, the majority of the tracks in the yard can be cleared for service quickly. The snow can then be loaded from the tracks, or it can be left to melt, depending on the need for the tracks taken out of service.

Organization Is of First Importance

By E. D. Swift

Engineer Maintenance of Way, Belt Railway of Chicago, Chicago

While we do not have heavy continued snows in Chicago very often, they occur at intervals almost every winter and our experience has demonstrated, at least to our satisfaction, that the proper organization of forces before the snow arrives is of prime importance. Accordingly, every fall we have a "snow meeting," attended by all who are to have charge of the various details of the work, so that the instructions and plans may be fully understood before the emergency arises.

Our principal concern at times of heavy snow storms in Clearing yard, where the classification of cars from and to a number of the larger roads entering Chicago is carried on. At the fall meeting, assignments of men are made to definite territories on the line, with the understanding that all extra forces are to be sent to Clearing immediately and

without further notice when heavy snow storms begin. In addition to these men, all bridge and building forces and certain clerks in the general offices on which the maintenance of way department has first call, likewise report to Clearing for duty. The men from the bridge and building gangs are used as squad foremen, while the clerks are assigned various duties as the occasion demands.

Boarding camps are operated by contract at Clearing the year round, but ordinarily are not filled to capacity during the winter months. In the fall, the commissary contractor is instructed to provide sufficient bunks, bedding, etc., to care for all the men that the camp will accommodate, including the lounging and recreation rooms, which are used as dormitories for the snow forces. During the winter the contractor maintains a man at night at his downtown office to engage such additional men as may be needed. Since Clearing yard is about 15 miles from the business district of Chicago and no regular passenger service is available, these men are sent to Clearing in taxicabs, rather than by street car, to insure their prompt transportation.

In handling the snow, it is usually necessary to keep the switches cleaned out, since the snow is seldom deep enough to cause trouble on the tracks in the body of the yard. The use of locomotives equipped with blower pipes taking high-pressure steam from the boiler and discharging it on both sides of the rail is effective when the snow is light and dry. We have 35 locomotives so equipped. It is necessary also to use shovels and brooms in cleaning switches and after this has been done, hydro-carbon is used, applied manually from safety cans to melt off any particles of ice that may have frozen on the points and stock rails. Little salt is used around the switches, as it has little effect at times of heavy storms.

After the storm lets up sufficiently to release some of the men from the work of cleaning switches, the piles of snow alongside the leads are levelled off to prevent the snow from drifting over the tracks on their lee sides. The snow is removed by loading into swinging-side coal cars, the side doors being propped open so that the snow can be cast into the car without throwing it over the sides. No attempt is made to pile the snow high in the cars since it would involve too much time and labor. After the cars are loaded they are hauled to the place of disposal and unloaded by hand. While Clearing yard is operated on a 24-hour basis, business is usually heaviest in the daytime, and for this reason the loading of the snow is often done at night.

Two important features in this kind of work are the proper tools and the feeding of the men. As has been said, the principal tools used are shovels, brooms and hydro-carbon cans. The stocks of these are checked up in the fall and provision is made for bringing them up to the required number at Clearing. The ordinary track shovel is used around switches, while the snow is loaded and unloaded with scoop shovels. For this latter purpose it has been found that locomotive firemen's scoops, which have become worn so that they are no longer fit for that purpose, answer very well as snow scoops, thus avoiding the necessity of buying new ones. For sweeping out switches, a specially-made corn broom is used, instead of the rattan brooms formerly employed. These brooms are reinforced in the center and are bound nearly to the ends of the straws. When the ends become badly worn, the lower tie is removed and the frayed end is cut off, making the broom available for further use. The corn brooms have proved well fitted for this work as they do not become clogged with ice and snow like the rattan broom.

Plenty of substantial food and coffee are furnished the men, since they cannot put forth their best efforts when they are both cold and hungry. Commissary cars, equipped with ranges for preparing the food, together with pails and baskets for carrying the food and coffee to the men, are set at convenient points. While the preparation of the food, which is in the form of sandwiches, is done by the commissary contractor's forces, the store department of the road is charged with the responsibility of ordering it and having it delivered without delay. At the smaller outlying yards, arrangements for feeding the men are made in advance with local restaurants, which are authorized to accept orders from the foremen, who turns in duplicate orders with their daily reports. Vouchers for these orders are made out and delivered promptly, and, in case any such orders are questioned, the voucher is issued and an investigation made afterwards.

Preparing Boarding Cars for Winter

What special measures should be taken in the preparation of boarding cars for bridge or other gangs engaged in winter work?

Provisions Must Be Made to Keep the Cars Warm

By H. S. Clarke
Engineer Maintenance of Way, Delaware & Hudson, Albany, N. Y.

We make it a practice to inspect the cars thoroughly with the thought in mind to repair broken windows, replace weather stripping where necessary, or in other words, to see that cars are tightly sealed for the winter. Provision is made for an ample supply of fuel and lighting systems are overhauled and placed in condition for the additional use that these outfits make of them during the winter when the days are short. The heating systems are also overhauled and put in first class condition.

Fire hazards are eliminated as far as possible by the insulation of stove pipes and the floors of cars where stoves or furnaces are located. Fire extinguishers are also inspected and put in good shape at this time.

Provide for Both Heat and Ventilation

By Division Engineer

Boarding cars for gangs engaged in winter work should be placed in condition to keep out the cold and to retain the heat, while provision should also be made for adequate ventilation. The first of these can be taken care of by ceiling the sides and roofs of the cars to provide an air space between the ceiling and the outer sheathing. This procedure is of benefit for all seasons of the year since the insulation thus provided will keep the cars cool in summer as well as in winter. While this is being done quite generally, there are still unceiled cars in service as boarding cars.

Special attention should be given to the protection of the cars from fire, and the thimbles through which the stove pipes pass through the roof should be inspected to see that they will function as intended. Men engaged in out-of-door work in the winter usu-

ally want plenty of heat when they come to the cars at night. The floors of the cars under the stoves should have sheet metal protection, as should also the walls when stoves are located near them.

The windows and doors should also be looked after to insure that they fit tightly, to prevent the entrance of cold air. Where windows are used for ventilation they should be located where they will not allow the air to blow directly on the men in the bunks, or, if this cannot be done, some sort of a shield should be provided to deflect the air currents.

Special Tools for Winter Use

What special tools should be furnished section gangs for winter use? Should these tools be returned to some central point in the spring?

Should Be Furnished When Work Is Scheduled

By V. H. SHORE
Yard Foreman, Atchison, Topeka & Santa Fe, Dodge City, Kan.

Where our work is programmed so that we do certain jobs during the winter when the track is frozen, such as repairing right-of-way and wing fences, burning right of way, keeping switches clear of snow and ice, renewing foot blocking in frogs, etc., it is necessary to have some special tools that we do not use at other seasons of the year except occasionally. These consist of post hole diggers, wire stretchers, claw hatchets or claw hammers and a hand saw, for repairing fences. Some kind of torch should be supplied for burning right of way. Snow brooms and snow shovels are required to keep switches clear of snow. Some of the brooms should be provided with a metal chisel point on the end of the handle to remove ice from switch points.

Large yards should be furnished a brace and bits for boring holes, when renewing foot blocking in frogs. The number of special tools furnished section gangs will vary in different parts of the country.

I cannot see where anything would be gained by shipping the special tools to a central point in the spring, but the foreman should be held responsible for them and take good care of them just as he does with the rest of his tools. Foreman will keep their tools in better condition if they retain them. If they are shipped he usually has other tools returned, which are likely to be in poor condition, and this has a tendency to make him careless in the care of tools.

Are Furnished Only to a Limited Extent

By H. R. CLARKE
General Inspector Permanent Way, Chicago, Burlington & Quincy, Chicago

We furnish very few special tools for winter work except snow brooms and these are kept at the tool houses the year round, together with the allotment of other tools. The gangs are reduced during the winter and this supply of tools is sufficient for whatever extra men may be secured at the smaller stations. In cases of blockades or other emergencies, extra gangs are sent to the scene of trouble and these gangs, of course, are supplied with all the tools they need. On some of our branch lines with light traffic, it is our practice to carry a supply of shovels on the local trains, to be used in emergencies by such men as can be picked up locally and these shovels are returned to the store department when the danger of snow blockades has passed.

Winter Troubles with Skylights

What are the troubles to guard against in skylights and ventilators in shops and roundhouses during the winter? What should be done to obviate these troubles?

Various Troubles May Be Expected

By P. AAGARD
General Building Inspector, Illinois Central, Chicago

The troubles to be guarded against in skylights and ventilators during the winter are due to several causes, among which are the breakage of glass in flat skylights on account of the weight of the snow; leaking, caused either by the poor condition or improper design of the flashing and counterflashing; condensation on the under side of the glass, and the entrance of snow through the ventilators.

For the first of these, it is necessary to remove the snow before it gets deep enough to break the glass, while the second can be cured by making a careful inspection of the flashing before winter sets in and sealing up any openings through which water could work its way, either by capillary action or otherwise. The only method to prevent condensation on the underside of the glass is to provide radiation around the inside of the skylight in order to keep the temperature sufficiently high so that the moisture in the air will not condense. All ventilators of the circular type, opening directly into the building, should be provided with dampers which can be operated from the floor of the building and all monitor sash should be constructed so that snow cannot enter between the sash and the frame.

There Should Be No Trouble if Properly Installed

By ASSISTANT ENGINEER OF BUILDINGS

The principal troubles with skylights and ventilators in the winter are breaking of the glass and leakage, but with proper installation and care these can be eliminated. The first of these has been overcome by the proper design of sash which will permit the glass to expand and contract without injury and which, at the same time, will prevent leakage. This is usually accomplished by using pads of felt or some plastic material between the panes of glass and the sash, and by providing sufficient space so that the glass will have a chance to adjust itself both longitudinally and transversely with changes in temperature. We have little trouble with condensation on the glass, but have had cases in the past where the condensation was annoying on the underside of concrete roof slabs which had not been insulated. These cases were remedied by applying the proper insulation.

The Troubles and Their Remedies

By J. SCHOFIELD
Architect, Canadian National, Montreal, Que.

The troubles to be guarded against in skylights during the winter are structural weakness in bars; lack of provision for expansion and contraction; lack of a suitable glass cushion; lack of proper exit for the escape of condensation; attacks of sulphuric acids and gases; poor glass and poor painting. To obviate these troubles, the following precautions are suggested: The use of solid metal bars of either tees, angles, channels or other suitable shapes or a combination of these shapes to insure the bars having sufficient strength to carry the glass and snow load with a deflection of not more than 1/30 in. per lin. ft. of span. The thickness

of any structural-steel member should be not less than 3/16 in. Bars constructed of sheet metal, with or without center reinforcement, should be avoided. Ample provision should be made so that the glass can expand and contract without coming into contact with any bolts or metal parts, and the glass cushions should be resilient and durable.

Weep holes at the curb line have not been satisfactory for the escape of condensation in some localities. A double apron, spaced slightly apart, would seem to be an improvement. Condensation gutters or eave troughs on the inside of the curb at the plate line have proved satisfactory. In railway shops or roundhouses the use of galvanized sheet metal should be avoided owing to the presence of sulphuric acids or gases. Copper, lead or aluminum sheets are more durable and satisfactory.

It is important that a good grade of glass be supplied, with wire mesh centrally embedded in the sheet. Welded wire is better than woven wire inasmuch as it can be placed more centrally than the latter sort and a more thorough bond of the glass with the wire is also assured, while breakage due to extremes in temperature is less liable to occur.

The structural steel members should receive at least two or three coats of a good protective paint, one coat before and one or two coats after erection. As the affected portions will at all times be accessible, no failure of the skylight can occur from corrosion so long as the painting is renewed when necessary. The collapse of skylights is frequently caused by weakness concealed from view in built-up bars. This difficulty can be avoided by using a solid bar construction and painting as above stated.

The troubles to be guarded against in ventilation are unsuitable material; poor draft; lack of dampers and insufficient anchorage. The material best suited for ventilation for roundhouses and shops, is copper, aluminum or protected metal. Galvanized sheets are not suitable on account of the liability of attack from sulphuric acids or gases. Published figures as to draft are in many cases found to be unreliable, and a test should be made in order to be sure that the required air change is provided. Dampers are advisable, with an adjusting device conveniently located to hold the dampers in a closed position, as well as in quarter, half and full open positions.

Substantial curbs should be provided with bolts to hold down ventilators mounted on the roof deck. When ventilators are mounted on skylights, structural shapes should be provided, in addition to the skylight bars, to which the bases of the ventilators should be attached securely.

On the Delaware, Lackawanna & Western

Capital Expenditures for Nine Months of 1928

NEARLY a billion dollars was expended by the Class I railroads on their tracks and structures during the first nine months of 1928, according to statistics prepared by the Bureau of Railway Economics. Expenditures for maintenance of way totaled $637,735,412, compared with $662,738,879 for the same period of 1927. This represents a reduction of $25,003,467, or 3.8 per cent. In the case of expenditures for improvements charged to capital account, the total for the nine months of 1928 was $334,200,000, compared with $365,223,000 for nine months of 1927, or a reduction of $31,000,000 or 8.5 per cent.

With respect to capital expenditures for equipment, the showing is less favorable, $165,967,000 being spent in the first three quarters of 1928, compared with $204,992,000 for the same period of 1927, a reduction of $39,000,000 or 19 per cent.

The capital expenditures of roadway and equipment for the first nine months of 1927 and 1928, as divided among primary classifications, are shown below:

Item	1928	1927
Equipment:		
Locomotives	$ 37,121,000	$ 53,721,000
Freight-train cars	89,920,000	104,565,000
Passenger-train cars	27,187,000	31,383,000
Other equipment	11,739,000	15,323,000
Total equipment	$165,967,000	$204,992,000
Roadway and Structures:		
Additional track	$ 91,241,000	$108,002,000
Heavier rail	34,891,000	35,199,000
Additional ballast	12,621,000	10,669,000
Shops and enginehouses	22,375,000	28,102,000
All other improvements	173,072,000	183,251,000
Total Roadway and Structures	$334,200,000	$365,223,000
Grand Total	$500,167,000	$570,215,000

It will be seen from the above that, whereas the expenditures for roadway and structures represented about 64 per cent of the total capital expenditures for the first nine months of 1927, the outlay for roadway and structures improvements during the first nine months of 1928 comprised 67 per cent of the total capital expenditures during that period. In the roadway and structure items, the expenditures for additional ballast were larger than in the same period of 1927 while those for heavier rail were substantially the same. It will be noted also, that the decrease in "All other items" was relatively small.

Considering all expenditures charged to capital account, the total for the first nine months of 1928 was $500,000,000. Compared with the corresponding period in 1927, this was a decrease of $70,000,000 or 12 per cent, while it also was a decrease of $129,000,000 or 20 per cent under the corresponding period in 1926.

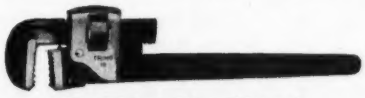
Railway capital expenditures for the calendar year 1928 are estimated at approximately $650,000,000. The expenditures made each year since the close of federal control in 1920 follows:

1920	$ 653,267,000
1921	557,035,000
1922	429,273,000
1923	1,059,149,000
1924	874,743,000
1925	748,191,000
1926	885,086,000
1927	771,552,000
1928 (estimated)	650,000,000
Total for nine years	$6,628,296,000

New and Improved Devices

Improved Trimo Pipe Wrenches

THE Trimont Manufacturing Company, Inc., Roxbury, Mass., has improved its line of Trimo pipe wrenches, in a way to increase their strength and effectiveness. Of primary importance among the improvements is the special heat treatment of the handle of the wrench to give it greater strength and toughness



The Trimo Pipe Wrench

than it possessed heretofore. The swinging steel frame, though not changed materially in appearance, has also been strengthened.

As a further improvement and safeguard, overlapping side lugs, which form an integral part of the handle, brace the frame effectively against lateral distortion or spreading. These reinforcing lugs are so designed that they furnish a rugged safety feature without in any way hampering the action of the frame or adding to the bulk of the wrench. The replaceable insert lower jaw and the nut-guards which protect the adjustment, are other features of the improved Trimo.

The New Fairmont A5 Extra-Gang Motor Car

A NEW heavy-duty motor car, designated as the A5 Extra-Gang Car, has been developed and placed on the market by Fairmont Railway Motors, Inc., Fairmont, Minn. The car is equipped with a four-cylinder Continental Red Seal industrial motor, model H9, developing 17 brake hp. at 1,000 r.p.m. and 33 hp. at 2,500 r.p.m., and providing sufficient power to haul gangs of from 50 to 200 men with the use of trailers.

A Brown-Lipe truck-type transmission, with multiple-disk dry clutch is used, affording three speeds forward and one in reverse, while the Fairmont reversible end-drive, with which the car is equipped, enables it to run backward with the three forward speeds of the transmission, thus avoiding the necessity of turning the car. The three speeds may be used for regular working speeds and this feature permits the car to be operated economically with varying loads and on varying grades. The drive is by shaft to the rear axle, with coupling to compensate for variations in wheel levels. A gear-driven water pump and large radiator, together with a pressure-feed oiling system, are provided to permit the engine to develop full power continuously without overheating and ball or roller bearings are used to reduce friction of rotating parts, there being seven ball bearings, four Bower, seven Timken and six Hyatt roller bearings in various parts of the car.

The body of the car is 9 ft. 1½ in. long, over all, with a width of 5 ft. 4 in., and will seat 12 men, with a load capacity of 4,000 lb. The frame is built of steel channels, securely cross braced to preserve the alignment of the axle boxes. The side sills of the deck and the side and cross members of the housing are of white oak, the deck is of yellow pine and the seat is of white pine. Tool trays, 8 ft. 6½ in. long by 12 in. wide, with a depth of 7 in. at the ends and insides and of 9 in. on

The A5 Extra-Gang Car Will Handle from 50 to 200 Men on Trailers

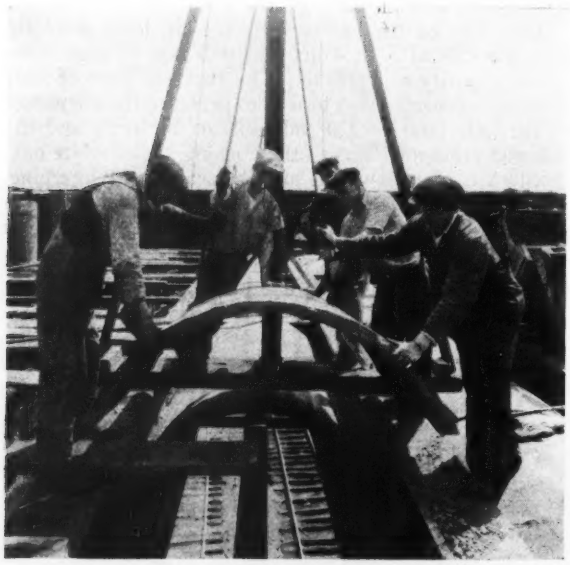
the outer sides, are provided on each side of the housing. Maple foot guards extend over the tops of the wheels and these are braced strongly enough to permit heavy loads being carried on them in cases of emergency. Safety rails are provided at each end of the side sills, and the brakes, which are controlled by a lever in front of the operator, are applied to all four wheels. The housing is hinged at the front end so that it can be swung back to permit access to the power plant and transmission without disturbing articles in the tool trays. A small section of the front part of the seat, together with the radiator guard, can also be swung back to clear the spark plugs, oil reservoir, fan and other parts, while the entire deck assembly can be lifted from the frame by removing four bolts, without interfering with the control levers or the fuel and ignition connections.

The car has a wheel base of 52 in., with wheels 20 in. in diameter. The rear axle is of 2½ in. stock, turned down and key-seated for the wheels and drive gear, while the front axle is 1⅞ in. in diameter. The axles run on Bower roller bearings which are sealed to keep out dirt and to retain the oil. The thrust collars are easily adjusted and are provided with large lugs to hold the inner sleeve of the race firmly on the axle.

The car weighs 1,700 lb. and has lift pipes across both ends of the side sills of the deck, while extension handles are furnished for easing the load when setting the car on or off the track. If desired, hump car and coach bodies can be furnished with the chassis as described, as well as with a longer wheel base.

Gunite Finds Place in Heavy Floor Construction

TO THE effective uses which are being made of Gunite by the Cement Gun Company, Inc., in various kinds of concrete work, another has been added which is particularly effective in connection with the construction of steel and concrete floors and bridge decks, especially where the steelwork is subject to the severe corrosive action and blasts of locomotive gases.

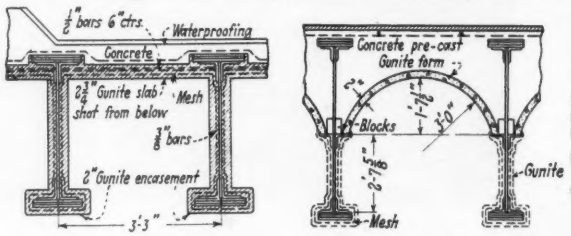


Setting a Preshot Gunite Slab in the Deck of a Bridge Over the Pennsylvania at Philadelphia

This use of Gunite, which is largely the result of efforts by the Pennsylvania, not only affords protection to the steelwork but also eliminates the expense of formwork and the inconvenience to traffic caused by form erection.

Essentialiy, the use of Gunite referred to employs either of two methods—the use of preshot Gunite arch forms which are left permanently in place or the shooting of Gunite forms directly in position; and in both instances encasing the exposed steel of the floor structure by a layer of Gunite. In the first method reinforced arch slabs of Gunite, two inches thick and of correct span, are prepared at the site of the work, and are then set in place between the girders of the floor system. These arches are allowed to rest either on the lower flanges of the girders or on shelf angles attached at the desired height to the webs of the girders. In this position the arch sections act as a form, on top of which the concrete jack arches and the deck are poured. Subsequently the steel members extending below the level of the arches are encased in Gunite, and at the same time all cracks between adjacent arch sections are sealed with this material.

The other method of using Gunite in constructing a steel and concrete floor or deck without extensive formwork, and at the same time providing protection for the steel and the concrete of the floor structure, is through the use of flat, shot-in-place Gunite slabs, instead of the preshot arch sections. This latter method



Sketches of Floor System, Showing the Use Made of Gunite Arches and Flat Slabs, and also the Method of Encasing the Steel

is adaptable particularly where there is close spacing of the steel members. In this method a light portable form panel, to which reinforcing mesh has been attached on the under-side, is placed on top of the steel members, and the Gunite is then shot against this form from below to form a slab of the desired thickness, usually between two and three inches. At the same time that this slab is being placed the steelwork is encased with Gunite, thereby making the encasement and the Gunite-supporting slab continuous.

After the slab has obtained sufficient strength the light panel form on top is removed and the reinforcing rods for the concrete floor slab are placed directly on top of the Gunite slab; the expansion rods first and then the stress rods. This results in saving the underprotection course of concrete generally provided, while

The Gunite Arches in Place Ready for the Pouring of the Jack Arches and the Floor Slab

at the same time obtaining the greater protection for the reinforcing which is afforded by the dense Gunite slab. With the rods in place, the floor slab is then poured in the usual manner.

In the work of encasing the exposed steel in connection with the above methods, reinforcing rods are fastened to the steel through shop-punched holes in the webs of the members and, subsequently, reinforcing

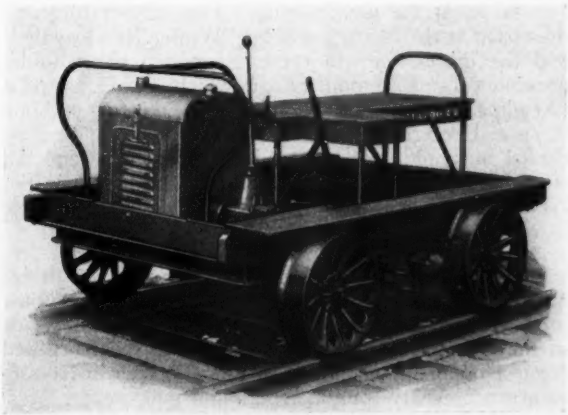
mesh is tied securely to the rods by wires. In the method using the flat Gunite slabs for the floor construction the reinforcing mesh of the slabs is continuous with that used for the steel encasement.

While the thickness of the encasement of Gunite may vary with the size of the member being encased, it is the recommendation of the Cement Gun Company that the thickness shall in no case be less than 1½ in. on vertical surfaces and above horizontal surfaces, and not less than 2 in. below horizontal surfaces and around the edges of lower flanges, the thickness being measured from the surface of the steel and not from the tops of rivets. All of the Gunite, which is a mixture of one bag of portland cement to three cubic feet of sand, is applied under pressure by a cement gun.

Two New Kalamazoo Cars

AN AUTOMOBILE type engine and an automobile type selective gear transmission are distinctive feature of the Kalamazoo No. 22 section motor car, recently placed on the market by the Kalamazoo Railway Supply Company of Kalamazoo, Mich. The new car is unique in several other respects; its appearance, for example, differing materially from conventional designs.

The two-cylinder, four-cycle, water-cooled engine, with three-inch bore and four-inch stroke, is mounted over and slightly forward of the front or driven axle, thereby concentrating such a large part of the weight of this car (1,125 lb.), on this axle, that one man can readily lift the rear axle off the rails. This greatly facilitates its removal of the car from the track. The



The No. 22 Section Car

seat does not extend over the engine as is the usual practice. The engine is covered with a sheet-metal hood which also incorporates a radiator for a thermo-syphon circulating system and a fuel tank. The seat, which is cut off behind the engine hood, is extended to the left at its forward end to provide a special seat for the operator, where he is afforded a clear vision to the rear, as well as ahead, and has convenient access to the ignition switch, throttle, clutch pedal, gear-shift lever and brake handle. This arrangement also provides an unusually large tool space.

The engine shaft is connected through a dry disc clutch at its left end to a high-grade transmission system that offers a selection of three speeds forward and one reverse. The maximum forward speed is about 35 m.p.h. A roller chain drive is provided from the transmission shaft to the front axle. Brakes, with replaceable cast-iron shoes, are provided on all four wheels. The sides of the engine housing are readily removable for access to the engine and the entire power plant can be removed in 15 min. by disconnecting the chain and removing four cap screws. The car can seat five or six men and has the capacity for hauling loaded trailers.

Another new car introduced by the same company is the Kalamazoo 216 L inspection car which com-

The Operator Has a Special Seat on the No. 22 Car

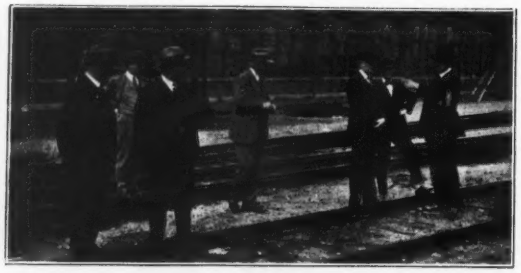
prises an improvement of the 16 L. As shown in the illustration, this is a small, light-weight inspection car, with the deck only 9 in. and the seat only 24 in. above top of rail. The car, which weighs 423 lb., can be easily taken off the track by one man, but has seating capacity for three men.

It has a one-cylinder, two-cycle engine with 3½-in. bore and 4-in. stroke, but unlike many small cars with two-cycle engines, the engine is free running, having a multiple-disc clutch between the engine shaft and the sprocket wheel for the chain drive.

The No. 216L Inspection Car

The car will travel at speeds ranging from 3 to 35 miles per hour in either direction and with the gear ratio provided as standard equipment, it will operate satisfactorily on all but the heaviest grades with exceptionally severe winds. Where such conditions are encountered, a larger sprocket will be furnished to increase the gear ratio. The new model is more simple of construction than the old one, has larger tool and seating space, and is equipped with cast iron brake shoes.

With the Associations



The Roadmasters Association

The executive committee will meet at the Hotel Stevens, Chicago, on Saturday, December 8, to appoint committees and plan other work for the ensuing year.

Bridge and Building Association

Maro Johnson, president, has called a meeting of the executive committee at the Engineers Club, Chicago, on December 8, to select the personnel of committees, consider a preliminary report of the arrangements committee, for the next annual convention and transact such other business as may come before it.

American Wood Preservers' Association

The following members of the American Wood Preservers' Association have been nominated as officers for the year beginning at the conclusion of the convention next January. President, H. E. Horrocks, manager, Pacific Creosoting Company, Seattle, Wash.; first vice-president, C. C. Cook, maintenance engineer, Baltimore & Ohio, Baltimore, Md.; second vice-president, J. S. Penney, general superintendent of plants, T. J. Moss Tie Company, St. Louis, Mo.; secretary-treasurer, H. L. Dawson; executive committee, S. R. Church, consulting engineer, New York City, and W. J. Smith, tie and timber agent, Missouri-Kansas-Texas, Denison, Tex.

The American Railway Engineering Association

The Board of Direction of the A.R.E.A., and the general committee of the Engineering division of the American Railway Association met in New York on November 20. At these meetings Secretary E. H. Fritch was appointed official representative to attend the World Engineering Congress at Tokio, Japan, in October, 1929.

The nominating committee also met in New York on November 20 and selected the following slate of officers to go on the ballot which will be distributed to the members within a few weeks.

President, Louis Yager, assistant chief engineer, N. P., St. Paul, Minn.

Vice-president, L. W. Baldwin, president, M. P., St. Louis, Mo.

Secretary, E. H. Fritch.

Treasurer, T. J. Stimson, assistant chief engineer maintenance, Penna., Chicago.

Directors, (three to be elected), J. E. Armstrong, assistant chief engineer, C. P. R., Montreal, Que.; C. B. Brown, chief engineer, C. N. R., Montreal, Que.; C. C. Cook, maintenance engineer, B. & O., Baltimore, Md.; C. R. Harding, engineer standards, S. P., San Francisco, Cal.; Frank Ringer, chief engineer, M-K-T., St. Louis, Mo.; C. E. Smith, vice-president, N. Y., N. H. & H., New Haven, Conn.; J. E. Willoughby, chief engineer, A. C. L., Wilmington, N. C.; T. J. Skillman, chief engineer, Penna., Philadelphia, Pa.; and D. J. Kerr, assistant to vice-president, G. N., St. Paul. In addition, G. D. Brook, general manager, C. & O., moves up automatically from second vice-president to first vice-president.

The number of applications for membership received since the close of the last annual convention in March, 1928, now aggregates 220, the largest number ever received in a similar period.

The committee work also shows more progress than in any preceding year, 19 of the 27 reports of committees being in the hands of Secretary Fritch on December 1. This work is so far advanced that the personnel of committees outline of work for the next year will be completed in time to be announced by January 1. By this means the working season of the committees will be extended three months and they will be well advanced in their work for next year by the time this year's reports are presented at the convention next March. By reason of this progress, the Board of Direction has set forward the date on which the committees are expected to have their reports in the hands of the secretary next year, from November 30 to November 1.

During the last month seven committees have met including those on Economics of Railway Operation on November 8, Economics of Railway Labor on November 8-9, Track on November 14, and Records and Accounts on November 20, all in Chicago. Rail in New York on November 21 and Wooden Bridges and Trestles in Chicago on November 24.

Metropolitan Track Supervisors' Club

The December meeting of the Metropolitan Track Supervisors' Club will be held on Thursday, Dec. 13, at Keen's Chop House, 72 West 36th Street, New York City. Luncheon will be served at 1 p. m., instead of at 3 p. m. as at the last meeting. The subject for consideration at the meeting will be, "Winter Rail Laying," and the discussion will center around a paper to be presented by a committee of which C. J. Lepperd (Reading) is chairman. Following the meeting an hour of special entertainment is planned, which will be concluded in ample time to permit members to attend the annual banquet of the New York Railroad Club in the evening.

Maintenance of Way Club

The meeting of the club on November 21 was designated as Past Presidents' Night. Four of the seven past presidents of the club were present to discuss the work of the club during the seven years of its existence and suggest opportunities for a further increase in its usefulness. Seventy-four members and guests were present. The next meeting will be held on December 19.

Directory of Associations

American Railway Bridge and Building Association—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, October 15-17, 1929, New Orleans, La.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn street, Chicago. Next convention, March 5-7, 1929, Palmer House, Chicago.

American Wood-Preservers' Association, H. L. Dawson, secretary, 228 North La Salle street, Chicago. Next convention, January 22-24, 1929, Louisville, Ky.

Bridge and Building Supply Men's Association.—W. D. Waugh, secretary, Detroit Graphite Company, Railway Exchange Building, St. Louis, Mo. Annual exhibit at convention of American Railway Bridge and Building Association.

National Association of Railroad Tie Producers—Roy M. Edmonds; secretary, Syndicate Trust Building, St. Louis, Mo. Next convention, April 23-25, 1929, Arlington Hotel, Hot Springs, Ark.

National Railway Appliances Association.—C. W. Kelly, secretary, 1014 South Michigan avenue, Chicago. Annual exhibit during convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—T. F. Donahoe, secretary, 428 Mansion street, Pittsburgh, Pa. Next convention, September 17-19, 1929, Chicago.

Track Supply Association.—L. C. Ryan, secretary. Oxweld Railroad Service Company, Chicago. Annual exhibit at convention of Roadmasters' and Maintenance of Way Association.

The Material Market

THE RAILROADS were a leading factor in the demand for iron and steel during the month of November. This was due to a minor extent to the seasonal lull in the automobile industry, but primarily to the large tonnage of rail orders placed or under consideration during the month. While the rail orders made public during November did not reach as large figures as those reported in October, they included some sizable tonnages, namely, 65,000 tons for the Louisville & Nashville and 50,000 tons for the Chicago, Milwaukee, St. Paul & Pacific. Smaller purchases included those of the Monon for 5,000 tons, of the Burlington for 19,500 tons and of the Missouri-Kansas-Texas for 10,000 tons.

The demand for track accessories has also been strong, particularly in the Chicago market, where sales have ranged from 7,000 to 20,000 tons per week during the past month and active inquiries have totaled about 30,000 tons from week to week. In addition, orders placed for 13,824 freight cars and 41 locomotives, as well as inquiries for many more, are responsible for a large demand for steel.

Iron and Steel Prices Per 100 Lb.

	October		November	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	$2.80	$2.80	$2.80	$2.80
Track bolts	3.80	3.80	3.80	3.80
Angle bars	2.75	2.75	2.75	2.75
Tie plates, steel	2.15	2.15	2.15	2.15
Boat spikes	3.00	3.00	3.00	3.00
Plain wire	2.40	2.45	2.40	2.45
Wire nails, keg	2.55	2.60	2.55	2.60
Barb, wire, galv	3.20	3.25	3.20	3.25
C. I. pipe, 6 in. to 12 in. ton		$43.20 to 45.20		$45.20 to 46.20
Plates	$1.90 to 2.00	2.00 to 2.10	$1.90 to 2.00	2.00 to 2.10
Shapes	1.90 to 2.00	2.00 to 2.10	1.90 to 2.00	2.00 to 2.10
Bars, soft steel	1.90 to 2.00	2.00 to 2.10	1.95 to 2.00	2.00 to 2.10
Rivets, struc.	2.90	3.00	2.90	3.00
Con. bars, billet	2.00		2.00	
Con. bars, rail	1.85	1.95	1.85	1.95
Rail per gross ton f.o.b. mills	43.00	43.00	43.00	43.00

Following a record production for steel in October, exceeding that in any previous month, the output declined during November, but with due allowances for possible further decreases in output during December there is an outlook for a total production of 50,000,000 tons for the year. This represents a gain of 6 per cent over the production of 1926, which was the previous high record. It goes without saying that an increase in output would not have taken place without an active demand, and this, of course, explains why the prices of most items have been steady or have increased throughout the year and are still generally strong. This tendency toward a strengthening of the prices of structural material was responsible for rumors of an advance for business placed during the first quarter of 1929. However, with a lessening demand during later weeks the prospect of such an increase in prices has become more remote.

Scrap Prices Per Gross Ton at Chicago

	October	November
Relaying rail (including angle bars)	$26.00 to $31.00	$26.00 to $31.00
Rails for rerolling	16.50 to 17.00	16.50 to 17.00
Rails less than 3 ft. long	17.25 to 17.75	17.50 to 18.00
Frogs and switches cut apart	15.50 to 16.00	15.75 to 16.25
Steel angle bars	16.50 to 17.00	16.50 to 17.00

Prices of track materials manifest their characteristic stability, with some fluctuation in the prices of track spikes. Steel tie plates are steady at $2.15 per 100 lb. Cast iron pipe prices are up, another advance having been made during November, following the rise in October.

The scrap market went through a temporary decline in the East early in November and some concessions in prices were made by the sellers. This resulted for a short time in a weakness of prices in western markets. However, during the later weeks of the month an increase in demand strengthened the market, and prices are now the same or slightly above those quoted last month.

The volume of orders for Southern pine declined consistently from the first week of October to the week ending November 9, when the orders received aggregated less than in any other week this year. The total for the following week was somewhat larger, but with production in excess of sales the volume of unfilled orders reflected a further decrease and was 18 per cent less than on October 5. Prices are reported to be moderately weak, although no downward trend is indicated in the table below. A seasonal falling off in business is also apparent in the statistics for west coast mills, which also show a curtailment in production. Some concessions have been made in prices, but these are not general and have not seriously affected the general level of prices.

Southern Pine Mill Prices

	October	November
Flooring, 1x4, B and better, flat	$40.43	$40.44
Boards, 1x8, No. 1	34.70	34.83
Dimension, 2x4, 16, No. 1, common	28.84	29.47
Dimension, 2x10, 16, No. 1, common	31.71	29.58
Dimension, 2x4, 16, No. 2, common	24.33	25.33
Dimension, 2x10, 16, No. 2, common	24.88	24.07

Douglas Fir Mill Prices

	October	November
Flooring, 1x4, B and better, flat	$25.25	$25.75
Boards, 1x8, No. 1	18.50	17.75
Dimension, 2x4, 16, No. 1, common	20.50	20.50
Dimension, 2x10, 16, No. 1, common	19.50	20.00
Dimension, 3x3 to 4x12, No. 1, common	22.00	20.50
Dimension, 5x5 to 12x12, No. 1, common rough	17.75	16.75

According to statement of G. S. Brown, president of the Portland Cement Association, production of Portland cement during 1928 will total more than in any previous year in the history of cement manufacture in the United States. Estimates indicate that the production for the year will aggregate about 175,000,000 bbl. No changes are noted in the prices of Portland cement at the different distributing centers given in the table below. These prices are per barrel in carload lots, not including packages.

New York	$2.25	Minneapolis	$2.22
Pittsburgh	2.04	Denver	2.55
New Orleans	2.40	Dallas	2.15
Chicago	2.05	San Francisco	2.41
Cincinnati	2.22	Montreal	1.41

On the Denver & Rio Grande Western in Colorado

Railway News

Briefly Told

Heavy rains during the week ending November 17, caused flood conditions in the streams in Eastern Kansas and Western Missouri which interrupted train service on railways entering Kansas City. At the same time, heavy rains near Quincy, Ill., caused overflows which interfered with train service in the bottom lands in Missouri near that city.

Fourteen freight cars, each carrying 49 tons, would have been required to carry sufficient gold to pay the taxes of the Class I railways in 1927, according to an estimate made by T. O. Edwards, general auditor of the Southern Pacific. The taxes of these roads in that year amounted to $376,110,243, or more than one million dollars a day, and represented more than six per cent of their total operating revenues.

The new North Station of the Boston & Maine at Boston, Mass., was dedicated and formally opened to the public on November 14, exactly a year after the announcement of the plans of that road for a modern station to supercede the former North Station. The Boston Garden, the large sports coliseum, convention auditorium and exposition hall over the station, has also been completed, while the 13-story North Station industrial building, an office and warehouse structure on the west of the new station, will be ready for occupancy on January 1.

The Public Service Commission of the State of New York has begun preliminary hearings on grade crossing elimination projects which have been recommended by the State Department of Public Works, by counties, cities, towns and by the commission itself. No less than 431 eliminations are being considered, involving an estimated expenditure of over fifty-six million dollars. The commission has issued a statement showing the proposed eliminations in each county, the statement including the name of the crossing, the name of the railway or railways interested, the municipalities in which the crossings are located and the estimated cost of each project.

The Great Northern plans to open its new tunnel through the Cascade mountains in Washington on December 28, at which time its entire line crossing these mountains, including about seventy-five miles of main line will be changed from steam to electric operation. The new tunnel, together with line revisions, provides a route nine miles shorter than the old one, with a reduction of 502 ft. in the summit elevation. The grades are lighter than on the previous line and curvature equivalent to nine complete circles has been eliminated. The cost of the entire project has been approximately $25,000,000. The tunnel, which is 7.78 miles long, is the longest tunnel in America and there are only four longer railways tunnels in the world.

The Supreme Court of the United States has permitted Donald C. Richberg, as Counsel for the National Conference on the Valuation of American Railroads, to file a brief and present oral argument in connection with the St. Louis & O'Fallon valuation case. Mr. Richberg takes the position that the law provides for a valuation of the railroads for rate-making purposes, and that a valuation of that kind represents an exercise of the legislative function rather than one for judicial ascertainment.

The wage controversy between the Western railways and their conductors and trainmen, was settled on November 23 when the employees accepted a 6½ per cent increase with no changes in working rules or conditions. The increase is retroactive to May 1, 1928, and will remain in effect for a minimum period of one year from date. It is estimated that the decision affects approximately 42,000 train service employees, and that the wage increase will amount to approximately $6,500,000 annually. The settlement was in line with the findings of the emergency board appointed by President Coolidge to consider the case, which recommended that the trainmen should either accept an increase of 6½ per cent in their pay with no changes in working rules or conditions, or of 7½ per cent if certain changes in working rules, notably the so-called "double-header rule," were adopted, as desired by the railways.

The Supreme Court of the United States has upheld the decision of a circuit court in New Jersey which denied an injunction sought by the Lehigh Valley against an order of the New Jersey Board of Public Utility Commissioners requiring the elimination of two grade crossings in Hillsborough by the construction of an overhead crossing at a cost to the railway of $234,000. The railroad objected that the expense was unreasonably large and that it could be reduced by $100,000 by introducing a six-degree curve in the public highway. Chief Justice Taft, in delivering the opinion, said that the case was one "which is near the line of reasonableness, but—we do not think it has gone beyond that line." Justice McReynolds, in a dissenting opinion, said the action of the commissioners was unreasonable and unjust and that to permit the commissioners to impose a charge of $100,000 upon the railroad under the pretense of objection to a six-degree curve in a country road is to uphold a plain abuse of power.

The Interstate Commerce Commission, in an order dated November 26, stated that additional installations of automatic train-control devices and of automatic block signals will not be required by order at the present time. In its investigations, the commission found that the number of accidents and casualties which result from disregard of fixed signals is relatively small in comparision with those resulting from other causes, such as from derailments or grade-crossing accidents, and stated as its belief that vigorous efforts to provide adequate protection against these latter will afford a far greater measure of safety than will an extension of train-control installations.

Highway grade crossing accidents in the first six months of the current year totaled 2,634, resulting in the death of 1,097 persons and the injury of 2,934 others, and constituting an increase of 73 accidents, 36 deaths and 33 injuries, as compared with the same period in 1927, according to a statement issued by the American Railway Association. Of the 1,097 fatalities, 893 resulted from accidents involving motor vehicles, an increase of 40 over the first six months of last year. While the total number of accidents, fatalities and injuries all showed increases, the percentage of increase has been less than the percentage of increase in the number of automobiles in use during the last few years. More than 20 per cent of the accidents at highway grade crossings in 1927 were caused by automobiles, motor coaches and motor trucks running into the sides of trains, such accidents accounting for 1,148 out of a total of 5,596 and causing 244 fatalities and 1,636 injuries. In many cases these vehicles first crashed through lowered crossing gates before striking the train.

Construction News

The Big Sandy & Cumberland has awarded contracts for the construction of a line from Devon, W. Va., to Grundy, Va., and to a point on the Levisa river, a total of 39 miles. Section 1, which includes the driving of a 1,500-ft. tunnel and is about 1 mile long, was let to W. W. Boxley, Roanoke, Va. Section 2, about 13 miles long, was let to Sturman-Dillard, Columbus, Ohio. Sections 3 and 4, which are about 11 miles and 14 miles long respectively and include the driving of a 3,750-ft. tunnel, were let to H. W. Nelson, Chicago.

The Canadian National has let a contract for the fabrication and erection of a bridge over Minnewashta creek near Miniota, Man., to the Manitoba Bridge and Iron Works, Winnipeg, Man. The cost of the superstructure of this bridge is estimated at $300,000. A contract has also been let to the Dominion Bridge Company, Ltd., Winnipeg, Man., for the fabrication and erection of the steel superstructure of a bridge at the third crossing of Moose Jaw creek at Moose Jaw, Sask. This bridge will consist of two 90-ft. deck plate girder spans, one 175-ft. deck truss span and two 42-ft. deck plate girder spans on a concrete substructure and will replace two 100-ft. deck Howe truss spans and one 120-ft. deck Howe truss span with trestle approaches. About 400 tons of structural steel are involved in this project. Company forces will be employed in construction of the sub-structure.

By an agreement effected with the promoters of the Sherritt-Gordon mine in Manitoba, this company will build a branch into that property from the line recently completed to the Flin Flon property; 42 miles. Under the arrangement, the promoters provide a cash guarantee of $1,500,000 together with a cash bonus of $125,000 for quick construction. The Dominion Construction Company, Winnipeg, will build the line.

The Canadian Pacific has let a contract to the Claydon Company, Winnipeg, Man., for the construction of a freight car shop at that point. The building with equipment will involve a total expenditure of more than $400,000.

The Chicago & North Western has announced plans for the elevation of the Chicago-Omaha, Neb., main line and the addition of two main tracks in the Chicago suburban district between the present westward end of track elevation at River Forest, Ill., and the east end of Proviso yard, about 2.25 miles. The project will involve a total expenditure of about $3,500,000 and will be completed in 1931 or 1932. Included in the work will be the widening of the Des Plaines River bridge for four tracks. The North Western has also authorized the expenditure of about $900,000 for the addition of a third main track between Gladstone Park, Ill., and Des Plaines, 7 miles.

The Chicago, Milwaukee, St. Paul & Pacific has awarded a contract for the excavation of about 250,000 cu. yd. of earth for track depression over a distance of about 2.5 miles at Milwaukee, Wis., to the H. W. Nelson Company, Chicago. Track will not be laid until some future date and temporary trestle crossings over the depression will be constructed by company forces.

The Florida East Coast has awarded a contract for the construction of an extension from Belleglade-Chosen, Fla., to Lake Harbor, on the west bank of the Miami canal, 9.5 miles, to the Correll-Young Company, Atlanta, Ga.

The Hudson Bay Railway, which is being constructed for the Canadian Government by the Canadian National, is having a passenger station built at The Pas, Man. In this structure, which will have outside dimensions of 26 ft. by 157 ft., special attention is being given to waterproofing and insulation because of climatic conditions in that part of Canada. The exterior walls and floor will be coated with felt, pitch and water-proofing and the concrete basement wall will be carried up to the level of the window sills, while the exterior walls above that level will be brick veneered.

The Minneapolis, St. Paul & Sault Ste. Marie has awarded the general contract for the construction of new terminal facilities at Ashland, Wis., to Frank Tomlinson, Ashland.

The Missouri-Kansas-Texas has let a contract to T. H. Johnson, Sedalia, Mo., for the construction of an eight-stall roundhouse and a machine shop at Smithville, Tex. The entire project will involve an expenditure of approximately $300,000. Equipment has been ordered from the Roberts & Schaefer Company, Chicago, for the construction of a sand storage and drying plant at the same point.

The Missouri Pacific has awarded a contract to W. P. McGeorge & Co., Pine Bluff, Ark., and Cape Girardeau, Mo., for the construction of a line between Illmo, Mo., and a point south of Cape Girardeau, 6 miles.

The New Orleans, Texas & Mexico, a subsidiary of the M. P., has applied to the Interstate Commerce Commission for a certificate authorizing the construction and operation of a line from the east bank of the Mississippi River at or near Baton Rouge, La., to a point at or near New Orleans, La., where connections may be had with the tracks of various lines, a distance of 82 miles, for the purpose of affording the Missouri Pacific system a new entrance to New Orleans. Between Baton Rouge and New Orleans the company now uses the tracks of the Yazoo & Mississippi Valley, through a trackage agreement under which it cannot participate in local business. The application states that the present line of the Missouri Pacific system from St. Louis to New Orleans is nearly one hundred miles longer than that of its strongest competitor and that the use of the proposed line would reduce this excess distance to about forty-three miles. It is also stated that the construction and operation of the proposed line will, in the opinion of the applicant, result in the construction of a bridge over the Mississippi at or near Baton Rouge that will be used in connection with the proposed extension.

St. Louis, Brownville & Mexico, another subsidiary, has applied to the Interstate Commerce Commission for a certificate for an extension from Weslaco, Tex., a distance of 10 miles.

An expenditure of $129,125 has been authorized for the construction of flood protection works along the Missouri River at 18 points on the Omaha division.

The Nashville, Chattanooga & St. Louis has prepared plans for the construction of a passenger station at Atlanta, Ga., which will include a two-story brick building over the station tracks, three butterfly train sheds with a maximum length of 1,250 ft. and five through and one spur tracks. The approximate cost of this work will be $350,000.

The New York Central has received bids for work in connection with the reconstruction of its Pier I, North river, New York. The project is expected to involve an expenditure of about $75,000.

Several contracts have recently been awarded by this road for work on its lines in New York and New Jersey. One, for the construction of a coach yard and truck platform at Buffalo, N. Y., was awarded to the John Johnson Construction Company, Buffalo, N. Y.; a second for the elimination of a grade crossing at Second and Akin avenues, Rensselaer, N. Y., went to the Bates & Rogers Construction Company, Inc., Chicago; a third, for piping work at the Harmon (N. Y.) power house went to W. F. Crane & Company, New York; the fourth, for the construction of ash pits at its Wayneport (N. Y.) coaling station, went to W. M. Ballard, Inc., Syracuse, N. Y., while the fifth, for the replacement of grain cleaning machinery in its elevator at Weehawken, N. J., was awarded to the M. A. Long Company, Baltimore, Md.

The Nicholas, Fayette & Greenbrier has been authorized by the Interstate Commerce Commission to construct a line from a connection with the New York Central at Swiss, W. Va., easterly to a connection with the Loop & Lookout at Nallen. The New York Central and the Chesapeake & Ohio are authorized to acquire control of the proposed road by the purchase of $400,000 of capital stock, which the commission has authorized, and also of $3,600,000 of promissory notes, and by

lease. The C. & O. has been authorized to construct one-fourth of a mile of line, including a bridge, to connect with the Kanawha & West Virginia at Beech Glen and to operate over that road to a connection with the Nicholas, Fayette & Greenbrier.

The Owensboro-Rockport Bridge Company has applied to the Interstate Commerce Commission for authority to construct a new line between Owensboro, Ky., and Rockport, Ind., including a bridge across the Ohio river and approximately 12 miles of track.

The Pennsylvania has awarded a contract for the elimination of grade crossings in connection with the construction of an extension of Grogan Yards, Columbus, Ohio, to the John F. Casey Construction Company, Pittsburgh, Pa. In addition to the separation of grades at Cleveland, Essex, Eleventh and Seventeenth avenues, the main tracks of the Toledo division will be relocated in the vicinity of the Ohio State fairgrounds. The cost of the entire project is estimated at $3,000,000.

A contract has been let to W. F. Trimble & Sons Company, Pittsburgh, Pa., for the erection of a fruit auction building at that point. The estimated cost of this work is approximately $500,000.

A contract has also been let by this road to the Roberts & Schaefer Company, Chicago, for the construction of a combined engine coaler and electric cinder plant at Washington, Pa. Another contract was awarded to the Crosoau Construction Company, Brownsville, Pa., for work in connection with the erection of an enginehouse, office and locker building and turntable pit at Benwood, W. Va. The work is expected to cost approximately $95,000.

A contract has been let to the Arthur McMullen Co., New York City, for the construction of masonry for the piers of the New Hackensack river bridge on its line at Marion, N. J. Approximately $1,000,000 is involved in this contract.

The St. Joseph & Grand Island has awarded a contract for the construction of a two-story brick and concrete freight station at Hastings, Neb., to Earl Ellis, Hastings. The cost of the station is estimated at about $50,000.

The St. Louis Public Service Board has awarded a contract to the Frazier-Davis Construction Company, St. Louis, Mo., for the construction of the timber deck and railroad approach to the Municipal bridge at St. Louis at a cost of about $203,000.

The San Luis Valley Southern plans the construction of and has surveyed the route for an extension from Jaroso, Colo., to Questa, N. M., 22 miles, which will involve an expenditure of about $300,000. It is planned to begin construction about March 1, 1929.

The Seaboard Air Line has awarded a contract to C. V. York Co., Inc., Raleigh, N. C., for the construction of a freight depot at Savannah, Ga. The project is expected to cost approximately $50,000.

The Southern has awarded a contract for the construction of a 1,000-ton capacity reinforced concrete automatic conveyor type coaling station with sanding facilities at Ashville, N. C., to Fairbanks, Morse & Co., Chicago. Another contract has been awarded to Fairbanks, Morse & Co. for the construction of a 1,000-ton capacity reinforced concrete automatic conveyor type coaling station, sanding facilities and a two-track cinder conveyor at Air Line Junction, Charlotte, N. C.

The Southern Pacific has been authorized by the Interstate Commerce Commission to construct a 6-mile line from Kerman, Calif., to Biola at an estimated cost of $252,379.

The secretary of war has authorized the construction of a bridge over Carquinez straits, about 30 miles east of San Francisco, Cal., which will do away with the present car-ferry transfer now operated between Port Costa and Benicia. The bridge will be double track, and will be 5,597 ft. long, including a 750-ft. viaduct approach, and will cost, together with the new line which it will be necessary to build, approximately $11,500,000.

The Texarkana & Fort Smith, the Texas lines of the Kansas City Southern, has announced tentative plans for the construction of a terminal at Dowling, Tex., which is situated adjacent to the main line between Beaumont, Tex., and Port Arthur, at an estimated total cost of $825,000. The classification yard and other facilities will involve the laying of about 20 miles of track. The mechanical facilities will include a turntable, an eight-stall roundhouse, a machine shop equipped for light locomotive repairs and a power plant, including generator, air compressor and power distribution lines.

The Texas-New Mexico has awarded a contract to Allhands & Davis for the grading for this railroad, which is a subsidiary of the Texas & Pacific, from Monahans, Tex., on the T. & P., through Ward and Winkler counties to the New Mexico state line, about 40 miles. Track laying will be done by company forces.

The Virginian has authorized the construction of 40.6 miles of line along the Guyandot river from Itmann to Gilbert, W. Va. The entire project is expected to cost approximately $7,500,000 and bids will be asked in the near future for the construction of the first 16.5 miles.

The Yankton, Norfolk & Southern has been authorized by the Interstate Commerce Commission to construct a 65-mile line from Yankton, S. D., south to Norfolk, Neb. The estimated cost of construction is $2,200,000 and of equipment $125,000.

Supply Trade News

General

The American Sheet & Tin Plate Company, Pittsburgh, Pa., has adopted a simplified branding system for its sheet and tin mill products, eliminating many brands which may have been confusing heretofore.

The Independent Pneumatic Tool Company, Chicago, will soon build an addition to its factory at Aurora, Ill. The new structure, for which plans have been approved, will consist of a modern concrete building with 36,000 sq. ft. of floor space.

The Louisville Frog & Switch Company and the Southern Signal Corporation, both of Louisville, Ky., have been consolidated as the Louisville Frog, Switch & Signal Company. **F. W. Carter,** president of both of the merged companies, has been elected president of the new organization.

The Timken Roller Bearing Company, Canton, Ohio, is carrying out a program for increasing its present output of 175,000 bearings daily to over 200,000 a day. About $6,000,000 was expended during the current year for additions to both the steel mill and the bearing factory, the former of which now has a capacity of 30,000 tons a month. The new facilities include additions to the plant at Canton and the purchase of the plant of the Weldless Steel Company, Wooster, Ohio.

Poor & Co., Chicago, has been organized to take over the P. & M. Company, Chicago, the Maintenance Equipment Company, Chicago, the P. & M. Company, Ltd., Montreal, Que., the Canton Forge & Axle Company, Canton, Ohio, the Vermillion Malleable Iron Company, Hoopeston, Ill., and the P. & M. Company, Ltd., London, Eng., the latter, in turn, owning 25 per cent or more of the capital stock of the P. & M. companies in France, Italy and Australia. The officers of the new company are **Fred A. Poor,** president, **Philip W. Moore** and **Fred A. Preston,** vice-presidents, **H. Lutkins,** secretary, and **H. C. Holloway,** treasurer.

The National Equipment Corporation, Milwaukee, Wis., has acquired the Parsons Company, Newton, Iowa, and the Insley Company, Indianapolis, Ind., following a previous acquisition of the Koehring Company and the T. L. Smith Company, Milwaukee. The Parsons and the Insley companies will continue under their present managements as divisions of the National Equipment Corporation. The officers of the National Equipment Company are: President and treasurer, **Philip A. Koehring,** formerly president and general manager and now general manager of the Koehring Company; vice-presidents, **W. J. Koehring,** vice-president of the Koehring Company; **W. H. Insley,** former president of the

Insley Company; **Harold E. Smith,** formerly president of the T. L. Smith Company, and **H. C. McCardell,** formerly president and general manager of the Parsons Company; secretary, **W. J. Zimmers.**

Personal

J. H. Chubb has been appointed manager of the service bureau of the Pennsylvania-Dixie Cement Corporation, with headquarters at the New York office, 131 East Forty-sixth Street.

W. D. Otter has been appointed Pacific Coast representative of the Locomotive Finished Material Company, Leavenworth, Kan., with headquarters in the Rialto Building, San Francisco, Cal.

Lowell S. Monroe, formerly advertising manager for the Electric Controller & Manufacturing Company, has been appointed engineer in charge of service data for the Copperweld Steel Company, Glassport, Pa.

Frank J. Baumis has become associated with the Ingersoll-Rand Company, New York. Mr. Baumis was formerly president of the Shaw Crane-Putnam Machine Company, Inc., and vice-president of Manning-Maxwell & Moore, Inc.

C. B. Moore, vice-president of the Oxweld Railroad Service Company, with headquarters at Chicago, has been elected chairman of the board, and **J. H. Rodger,** formerly vice-president of the Safety Car Heating & Lighting Company, New York, has been elected vice-president.

John A. Manley, manager of sales development of Fairbanks, Morse & Co., Chicago, whose election as vice-president in charge of sales, was noted

John A. Manley

in the November issue, graduated from Northwestern University in 1911 and later entered the sales department of the Republic Tire & Rubber Company. In 1915, he became a member of the advertising staff of a newspaper in Chicago and afterwards was connected with Hart, Schaffner & Marx. He resigned from this position to become manager of accounts for Henri, Hurst & McDonald, advertising agency, Chicago. He entered the service of Fairbanks, Morse & Co. in 1925, as manager of sales development, which position he was holding at the time of his recent election as vice-president.

Frederick K. Copeland, president of the Sullivan Machinery Company, Chicago, since its organization in 1892, died suddenly at Claremont, N. H., on November 10, following an attack of peritonitis. Mr. Copeland was born on

Frederick K. Copeland

August 22, 1855, at Lexington, Mass., and graduated from the Massachusetts Institute of Technology in 1876. He entered the operating department of the Chicago, Burlington & Quincy in the same year and later was engaged in mining engineering work in Iowa and Colorado until 1884, when he was one of the organizers of the Diamond Prospecting Company, of which he was made president. In 1892, when the Sullivan Machinery Company was formed by the merger of the Diamond Prospecting Company and the Sullivan Machine Company, Mr. Copeland was made president of the new organization, which position he was holding at the time of his death.

John K. Shaw, vice-president and director of the Celotex Company, Chicago was killed by the accidental discharge of his shotgun while hunting near Arlington, S. D., on November 2. Mr. Shaw was born on August 3, 1872, in Dane County, Wis., and was educated at the Northern Indiana College, Valparaiso, Ind. After completing his college course he engaged in the manufacture of furniture as a member of the firm of Peek, Dahlberg & Shaw, Minneapolis, Minn. He became associated with B. G. Dahlberg in 1910, and from 1917 to 1921 was sales manager for the Insulite Company, Minneapolis. He was one of the organizers of the Celotex Company in 1920, of which he was elected vice-president and sales manager. During the last year he relinquished his duties as sales manager in order to rest, and was holding the position of vice-president at the time of his death.

Personal Mention

General

H. L. Wheeler, supervising engineer of the San Joaquin & Eastern, with headquarters at Auberry, Cal., has been promoted to superintendent, with headquarters at the same point.

R. A. Feldes, chief engineer of the Indiana Harbor Belt, with headquarters at Gibson, Ind., has been promoted to assistant to vice-president and general industrial agent, with headquarters at La Salle Street Station, Chicago.

Edward J. Pearson, president of the New York, New Haven & Hartford, and an engineer by education and experience has resigned on account of ill-health. Mr. Pearson was born in October, 1863, at Rockville, Ind., and graduated from the engineering department of Cornell University. He entered railway service in 1881 as a rodman on the Missouri Pacific. In 1882, he became an assistant engineer on the Missouri-Kansas-Texas, and in the same year, served in the same capacity on the Atlantic & Pacific (now a part of the Atchison, Topeka & Santa Fe). From 1883 to 1885, he was an assistant engineer on the Northern Pacific, when he was promoted to supervisor of bridges, buildings and water supply on the Minnesota and St. Paul division, and in May, 1890, he was further promoted to division engineer of the Eastern division. From May, 1892, to June, 1894, he was principal

Edward J. Pearson

assistant engineer in charge of construction of the Chicago & Northern Pacific (now a part of the Baltimore & Ohio Chicago Terminal) and of work on the Wisconsin Central (now a part of the Minneapolis, St. Paul & Sault Ste. Marie), both of which roads were controlled by the Northern Pacific at that time. In June, 1894, Mr. Pearson entered the operating department as superintendent of the Yellowstone division and later served in the same ca-

pacity on various other divisions until April, 1902, when he was promoted to assistant general superintendent, with headquarters at St. Paul, Minn. In September, 1903, Mr. Pearson was promoted to acting chief engineer, and this was followed on May 1, 1904, by his advancement to chief engineer, with headquarters at St. Paul. In December, 1905, he became chief engineer of the Coast extension of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Seattle, Wash., remaining in that position until June, 1911, when he was elected first vice-president of the Missouri Pacific System, with headquarters at St. Louis, Mo. In April, 1915, he was elected first vice-president of the Texas & Pacific, with headquarters at New Orleans, La., remaining in that position until April, 1916, when he was elected vice-president of the New York, New Haven & Hartford, with headquarters at New Haven, Conn. Mr. Pearson was elected president of the New Haven in May, 1917.

Fred Lavis, consulting engineer, New York, much of whose active life has been spent in the location and construction of railways in both North and South America, has been elected president and a director of the International Railways of Central America. Mr. Lavis was born in England in 1871 and came to this country in 1887. He entered railway service in 1889 as an inspector in the engineering department of the Boston & Maine and a year later became a rodman and transitman on railway and harbor construction at Signa, Cuba, following which he was engaged in railway work in Colombia. From 1894 to 1897, he was an assistant engineer on the Providence division of the New York, New Haven & Hartford, and in 1888 and 1889, he was locating and resident engineer on the Chihuahua & Pacific (now a part of the Mexico North Western). He returned to the United States in 1900 as an assistant engineer on the Boston & Maine, and became an assistant engineer on the Exeter & Hampton Street Railway in 1901. Mr. Lavis was locating engineer on the Choctaw, Oklahoma & Gulf (now a part of the Chicago, Rock Island & Pacific) in 1902 and 1903, following which he was an assistant engineer on the New York Central & Hudson River (now a part of the New York Central) and later, from 1903 to 1905, was an assistant engineer with Westinghouse, Church, Kerr & Co. In 1905, Mr. Lavis became locating engineer for the New York, Westchester & Boston, and from 1905 to 1909, was resident engineer on the Pennsylvania tunnels at New York. After their completion, he entered practice as a consulting engineer, specializing in economics of transportation, finance, location and construction of railways. In this capacity he made examinations of railway projects in Spain, Italy, Central America and South America, as well as in the United States and also was chief engineer of the Argentine Railway and the Uruguay Railway Company. His first connection with the railways which now form part of the International Railways of Central America was in 1911, when he made an examination of them for the National City Bank of New York. In 1916, he made another study of these properties and for the past two years has been consulting engineer for the board of directors, with particular reference to the construction of the connecting link between Guatemala and Salvador, and additions and betterments to the existing lines.

Fred Lavis

Engineering

M. F. Longwill, assistant to the president of the Wabash with headquarters at St. Louis, Mo., has been appointed chief engineer, succeeding R. H. Howard, deceased.

D. A. Young, valuation engineer of the Chicago Junction, with headquarters at Union Stock Yards, Chicago, has been promoted to assistant chief engineer, with headquarters at the same point, and the position of valuation engineer has been abolished.

Otto Gersbach, chief engineer of the Chicago Junction, with headquarters at Union Stock Yards, Chicago, has been appointed chief engineer of the Indiana Harbor Belt, with headquarters at Gibson, Ind., succeeding **R. A. Feldes,** whose promotion to assistant vice-president and general industrial agent, is noted elsewhere in this issue.

J. O. Armstrong, whose promotion to division engineer of the Northern division of the St. Louis-San Francisco was noted in the September issue, was born on April 29, 1886, at Holton, Kan., and was educated at Kansas State College. Mr. Armstrong entered railway service in April, 1912, as a rodman on the Great Northern, and in February, 1914, became a draftsman on the Washington, Idaho & Montana. He entered the United States Reclamation Service in August, 1914, and in November, 1915, became a draftsman on the Atchison, Topeka & Santa Fe. In September, 1916, he entered the service of the Missouri Pacific as a draftsman, and in January, 1917, became a draftsman on the Frisco, with which road he has been connected since that time, serving successively as draftsman, computer and instrumentman until August, 1918, when he was promoted to assistant engineer in charge of the office of the district engineer at Springfield, Mo. In March, 1920, Mr. Armstrong was promoted to assistant division engineer of the Northern division, with headquarters at Fort Scott, Kan., which position he was holding at the time of his recent promotion to division engineer of the same division.

W. C. E. Robinson, whose promotion to division engineer on the Canadian Pacific, with headquarters at Toronto, Ont., was noted in the September issue, was born on November 12, 1891, at Coldwater, Ont., and was educated at the Whitby and Orillia Collegiate Institute. Mr. Robinson entered railway service in 1910 in the construction department of the Canadian Pacific, where he served successively as chainman, rodman and instrumentman until 1914, when he entered the Canadian Expeditionary Forces as a private and served overseas. He was promoted to second lieutenant in 1915 and in 1917 was made lieutenant in the Royal field artillery of the British Expeditionary Forces. On his return to civil life in 1919, he became assistant engineer on the Lake Erie & Northern, and the Grand River electric railways at Galt, Ont. In 1922, he became a resident engineer in the construction department of the C.P.R. and from 1924 to 1926, was transitman on the Chapleau and Toronto Terminal divisions. Mr. Robinson was promoted to assistant engineer of the latter division in 1926, which position he was holding at the time of his promotion to division engineer.

W. C. E. Robinson

J. L. Campbell, whose appointment as acting chief engineer of the Northwestern Pacific, with headquarters at San Francisco, Cal., was noted in the

November issue, has been promoted to chief engineer. Mr. Campbell was born in Illinois in 1863 and entered railway service in 1895 as a resident engineer on construction on the Rio Grande Northern. He became a locating engineer on the Rio Grande, Sierra Madre & Pacific (now the Mexico North Western) in the following year and in 1897 he became chief engineer of location and construction of the El Paso & Northeastern (now a part of the Southern Pacific). He subsequently served until 1904 with the Atchison, Topeka & Santa Fe and the Arizona & New Mexico (now a part of the Southern Pacific) and was chief engineer of the St. Louis, Kansas City & Colorado (now a part of the Chicago, Rock Island & Pacific) during its construction near St. Louis.

J. L. Campbell

In 1905, he was appointed engineer maintenance of way of the El Paso & Southwestern, and was promoted to chief engineer in 1920. When the E. P. & S. W. was merged with the Southern Pacific in 1924, Mr. Campbell became assistant to the chief engineer of the latter road, which position he was holding at the time of his recent appointment as acting chief engineer of the Northwestern Pacific.

T. P. Polson, assistant division engineer on the New York, New Haven & Hartford, at Danbury, Conn., has been promoted to division engineer on the Boston division, with headquarters at Boston, Mass., succeeding **A. L. Bartlett,** who has been transferred to New Haven, Conn., where he takes the place of **H. F. Fifield,** who resigned to become engineer maintenance of way of the Boston & Maine as noted elsewhere in these columns. **A. A. Cross,** track supervisor at Putnam, Conn., has been promoted to assistant engineer at Danbury to succeed Mr. Polson. **R. W. Dawson,** cost engineer on the New Haven, with headquarters at Waterbury, Conn., has been promoted to assistant engineer at Waterbury, succeeding **C. D. Prentice,** who has been appointed assistant supervisor, and **J. B. Whittemore,** assistant supervisor on the Danbury division, with headquarters at Danbury, has been promoted to assistant engineer on the same division, with headquarters at the same point, succeeding **S. J. Polson,** who has been transferred to New Haven to succeed **G. P. Elliott,** who has been appointed assistant track supervisor.

Mr. Dawson, who was born at West Cape May, N. J., on October 24, 1897, graduated from Lafayette College in 1921, entered railway service on September 5, 1922, in the maintenance of way department of the New Haven, at Waterbury, and subsequently held various positions in this department, both at New Haven and at New London, Conn. He was appointed cost engineer on September 16, 1926, and held this position until his recent promotion to assistant engineer.

Mr. Whittemore, who was born on March 17, 1878, at Providence, R. I., attended Brown University, and entered railway service in October, 1899, as a locomotive fireman on the New Haven. In 1908, Mr. Whittemore was a chainman on the Southern Pacific, and from 1910 to 1914, he was roadmaster on the Shore Line Electric Railway, at Saybrook, Conn. From 1914 to 1916, he was roadmaster on the Norwich & Westerly Traction Company at Norwich, Conn., following which he was superintendent of way and structures on the Shore Line Electric Railway. He became cost engineer on the New Haven in 1920, and assistant track supervisor in 1923, which latter position he was holding at the time of his recent promotion to assistant engineer.

William F. Cummings, engineer maintenance of way of the Boston & Maine, with headquarters at Boston, Mass., has been promoted to assistant chief engineer, with headquarters in the same city, and **Harold F. Fifield,** formerly division engineer on the New York, New Haven & Hartford, with headquarters at New Haven, Conn., has been appointed engineer maintenance of way to succeed Mr. Cummings. **Joseph A. Parant,** engineer of standards, with headquarters at Boston, has been promoted to principal assistant engineer with headquarters in the same city to succeed **Charles J. Griffin,** who has been promoted to construction engineer in charge of the Boston Terminal improvements.

Mr. Cummings was born on December 9, 1887, at Charlestown, Mass., and entered the service of the Boston & Maine in October, 1906, as a chainman, being promoted successively to rodman, transitman and assistant engineer. In April, 1914, he entered the valuation department as an assistant engineer and this was followed in January, 1920, by his promotion to assistant valuation engineer and by his further promotion to valuation engineer in 1921. He was appointed auditor of disbursements in January, 1926, and in April, 1927, he was appointed engineer maintenance of way, which position he was holding at the time of his promotion to assistant chief engineer on November 1. Mr. Cummings will be in charge of and responsible for standards, engineering design, valuation and real estate engineering.

Mr. Griffin was born on May 25, 1882, at Everett, Mass., and graduated from the Massachusetts Institute of Technology in 1904. He entered railway service on October 21 of the same year as an inspector on the Boston & Maine, leaving that position in December, 1906, to become a transitman on the New York, New Haven & Hartford. He returned to the B. & M. on May 1, 1911, as an assistant engineer and in Febrary, 1913, he was promoted to division engineer on construction, in which capacity he served until February, 1914, when he was promoted to assistant valuation engineer. He was appointed construction engineer in August, 1918, and in August, 1924, he entered the maintenance of way department, where he remained until June, 1926, at which time he was promoted to real estate engineer. He was promoted to principal assistant engineer on April, 1927, which position he was holding at the time of his promotion to construction engineer on November 1, in which position he will have charge of the Boston Terminal improvements.

R. S. Stewart, division engineer of the New York division of the Pennsylvania, with headquarters at Jersey City, N. J., has been promoted to engineer maintenance of way of the Philadelphia Terminal division, with headquarters at Philadelphia. Pa. **F. M. Hawthorne,** division engineer of the Philadelphia Terminal division of the Pennsylvania, with headquarters at West Philadelphia, Pa., has been promoted to engineer of maintenance of way of the Lake division, with headquarters at Cleveland, Ohio, succeeding **F. M. Graham,** who has been promoted to assistant engineer of standards, with headquarters at Altoona, Pa. **S. R. Hursh,** supervisor at North Philadelphia, has been promoted to division engineer on the Atlantic division at Camden, N. J., succeeding **R. J. Bond,** who has been promoted to assistant to the engineer maintenance of way of the Southern division. **J. F. Swenson,** supervisor on the Philadelphia division, with headquarters at Lancaster, Pa., has been promoted to division engineer on the Tyrone division, with headquarters at Tyrone, Pa., succeeding **W. W. Portser,** who was transferred to the Baltimore division, with headquarters at Baltimore, Md., where he succeeds **J. G. Hopkins,** who has been appointed assistant engineer in the valuation department at Philadelphia. **H. W. Anderson,** supervisor on the New York division, with headquarters at New Brunswick, N. J., has been promoted to division engineer of the Akron division, with headquarters at Akron, Ohio, succeeding **H. J. Shaw,** who has been made assistant to the division engineer of the Erie & Ashtabula division, at New Castle, Pa. **C. W. VanNort,** supervisor on the

Pittsburgh division, with headquarters at Johnstown, Pa., has been promoted to division engineer of the Erie and Ashtabula division, with headquarters at New Castle, Pa., to succeed **J. G. Hartley,** who has been appointed division engineer of the Long Island, with headquarters at Jamaica, N. Y.

Track

Roger L. Stewart has been appointed district roadmaster on the Tacoma division of the Northern Pacific, with headquarters at Centralia, Wash., to succeed **Peter L. Demmer,** deceased.

R. S. Kniffen, division roadmaster on the Mesabi division of the Great Northern, with headquarters at Superior, Wis., has been promoted to general roadmaster of the Lines East of Williston, with headquarters at St. Paul, Minn., to succeed **George G. Smart,** who has been appointed supervisor of work equipment, a newly created position. **L. J. Gilmore,** district roadmaster, with headquarters at Kelly Lake, Minn., has been promoted to division roadmaster to succeed Mr. Kniffen

H. F. Varblow, whose promotion to supervisor on the Grand Trunk Western, with headquarters at Durand, Mich., was noted in the October issue, was born on March 28, 1879, in Germany, being brought to the United States by his parents in 1882. Mr. Varblow entered railway service on April 15, 1901, as a section laborer on the G. T. W. at Imlay City, Mich. He was promoted to section foreman at Imlay City on May 26, 1908, which position he was holding at the time of his recent promotion to supervisor. During the last 10 years, Mr. Clark was extra gang foreman in charge of rail relaying gangs, returning to his duties as section foreman during the winter months.

J. Bain, section foreman on the Canadian Pacific, at Moosomin, Sask., who also acted as relieving roadmaster, has been promoted to roadmaster on the Moose Jaw division, with headquarters at Assiniboa, Sask., to succeed **A. J. G. Murdock,** who has been transferred to the Fife Lake and Wood Mountain subdivisions of the same division. **Wm. McCrea,** formerly relieving roadmaster on the Sudbury division, has been promoted to roadmaster on the same division, with headquarters at Chapleau, Ont., to succeed **C. J. Francis,** who has been transferred to the London division, with headquarters at London, Ont., where he replaces **T. J. Lackey,** who, in turn, has been transferred to the Bruce division, with headquarters at Orangeville, succeeding **George Sproule,** transferred.

Alfred L. Clark, whose promotion to supervisor on the Grand Trunk Western, with headquarters at Durand, Mich., was noted in the October issue, was born on February 18, 1894, at Gaines, Mich., and entered railway service as a section laborer on the G. T. W. at Swartz Creek, Mich., on April 5, 1915. He was promoted to section foreman at the same point on October 31, 1915, and held that position until May 15, 1918, when he entered the United States Army, with which he served seven months overseas. On his return to civil life in May, 1919, he resumed his duties as section foreman at Swartz Creek. Mr. Clark served as extra gang foreman during the summers of 1925 to 1928, inclusive, and was holding that position at the time of his recent promotion to supervisor.

C. D. Prentice, assistant engineer on the New York, New Haven & Hartford at Waterbury, Conn., has been appointed assistant supervisor at the same point, succeeding **J. B. Bell,** who has been promoted to supervisor at Putnam, Conn., where he succeeds **A. A. Cross,** whose promotion to assistant engineer is noted elsewhere in these columns. **G. P. Elliot,** assistant engineer on the New Haven, with headquarters at New Haven, has been appointed assistant supervisor on the Danbury division, with headquarters at Danbury, succeeding **J. B. Whittemore,** whose promotion to assistant engineer is also noted elsewhere in this issue.

Mr. Bell, who was born on February 9, 1896, at Providence, R. I., entered the engineering department of the New Haven as a rodman in 1913, and subsequently held various positions in that department until May, 1917, when he entered the United States army. After serving in France until July, 1919, he returned to the New Haven as a transitman and in 1920 was appointed cost engineer. In May, 1924, he was promoted to assistant engineer at Waterbury, and in February, 1926, was transferred to New Haven. In October of that same year he was made assistant track supervisor at Waterbury, which position he held until the time of his recent promotion to supervisor.

R. W. Sheffer, assistant supervisor on the Pennsylvania, with headquarters at West Philadelphia, Pa., has been promoted to supervisor on the Sunbury division at Wilkes-Barre, Pa., succeeding **R. H. Joyce,** transferred to the Philadelphia division at Lemoyne, Pa., where he succeeds **D. Davis, Jr.,** who has been transferred to North Philadelphia. **E. P. Filippelli,** assistant supervisor on the Baltimore division, at Baltimore, has been promoted to supervisor on the Trenton division, with headquarters at Jamesburg, N. J., succeeding **J. S. Gillum,** who has been transferred to the Philadelphia division at Lancaster, succeeding **J. F. Swenson,** whose promotion to division engineer is noted elsewhere in this issue. **C. F. Trowbridge,** assistant supervisor on the New York division with headquarters at Trenton, N. J., has been promoted to supervisor on the Baltimore division, with headquarters at York, Pa., succeeding **J. E. Vandling,** who has been transferred to the New York division, at New Brunswick, N. J., where he succeeded **H. W. Anderson,** whose promotion to division engineer is noted elsewhere in this issue. **C. P. Willis,** supervisor on the Cleveland division, with headquarters at Wellsville, Ohio, has been transferred to the Pittsburgh division at Johnstown, Pa., to succeed **C. W. VanNort,** whose promotion to division engineer is noted elsewhere.

Purchasing and Stores

John Eaton has been appointed assistant to the general purchasing agent of the Canadian Pacific, with headquarters at Montreal, Que. **W. J. Burns** and **R. H. Yarnell** have been appointed assistant purchasing agents with headquarters at Montreal and Quebec, respectively.

Edward T. Monroe, chief clerk in the purchasing department of the Buffalo, Rochester & Pittsburgh at Rochester, N. Y., has been promoted to general purchasing agent at Rochester.

Obituary

William B. Schuessler, formerly superintendent of bridges on the New York, New Haven & Hartford, with headquarters at Danbury, Conn., who retired in 1921, died on October 28 at Milwaukee, Wis., at the age of 77 years.

Alex. Findley, former master of bridges and buildings on the Grand Trunk (now a part of the Canadian National), with headquarters at Montreal, Que., died on November 18.

O. P. Ronning, roadmaster on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Montevideo, Minn., died on September 17 in the Montevideo hospital. Mr. Ronning was born on January 15, 1855, at Aamat, Norway, and came to the United States in 1882. He entered railway service in the same year as a section laborer on the Chicago, Milwaukee & St. Paul at Milbank, S. D. He was promoted to section foreman three years later, and in 1888 was further promoted to roadmaster on the H. & D. division, and had his headquarters at Montevideo.

John F. Shanahan, retired roadmaster on the Lake Erie & Western district of the New York, Chicago & St. Louis, died at his home in Bloomington, Ill., on September 18. Mr. Shanahan was born on December 27, 1860, at Muncie, Ind., and entered railway service in 1880 as a section laborer on the Ft. Wayne division of the Lake Erie & Western (now a part of the N. Y., C. & St. L.). He was promoted to section foreman in 1884 and served in that capacity at Bluffton, Ind., and Muncie until 1902, when he was promoted to roadmaster of the Ft. Wayne division, with headquarters at Ft. Wayne, Ind. In 1906, he was transferred to the Western division, with headquarters at Bloomington, Ill., where he remained until ill-health caused his retirement.

Charles A. Pigford, who retired from active service in 1921 as superintendent of the Gulf, Mobile & Northern, with headquarters at Laurell, Miss., and whose early railway experience was gained in the maintenance of way department, died at his home in Memphis, Tenn., on November 10.

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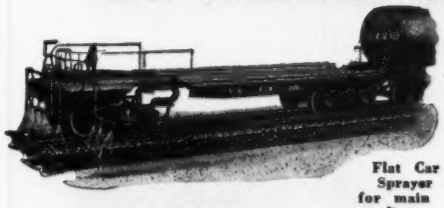

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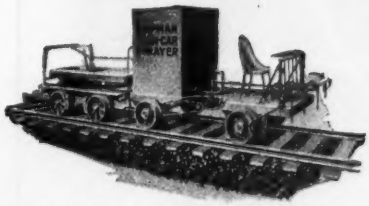

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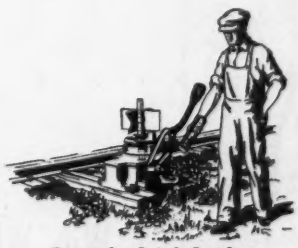

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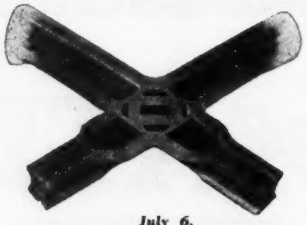

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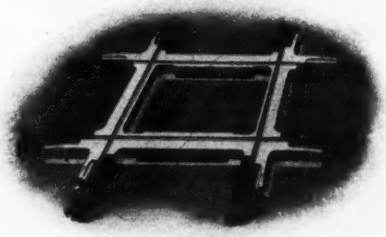

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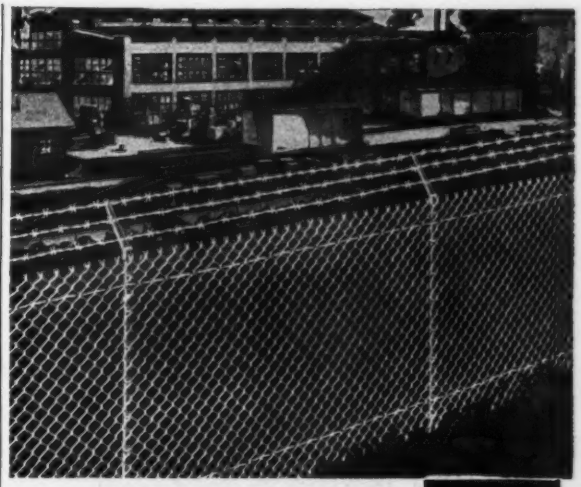

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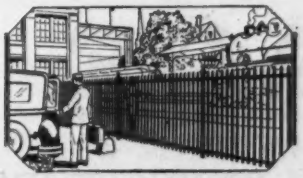

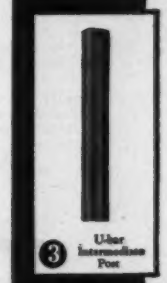

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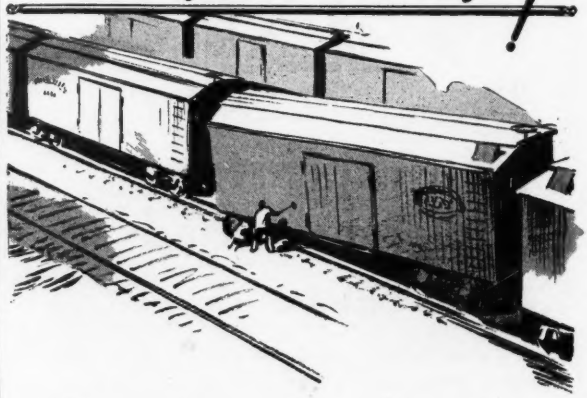

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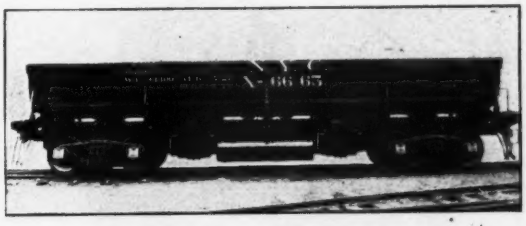

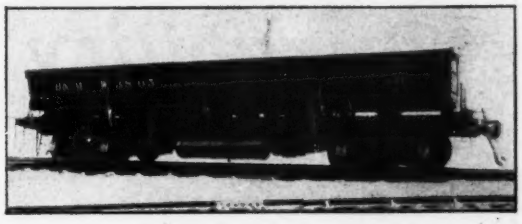

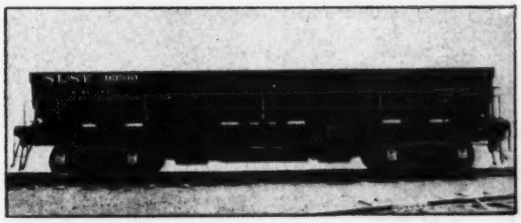

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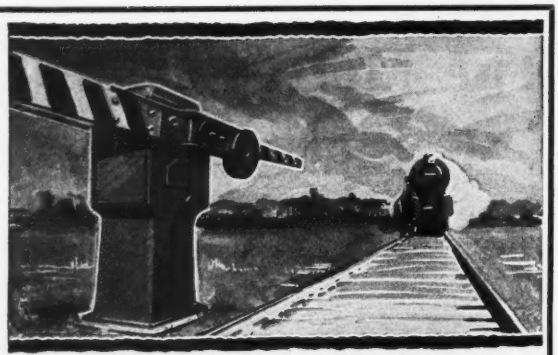

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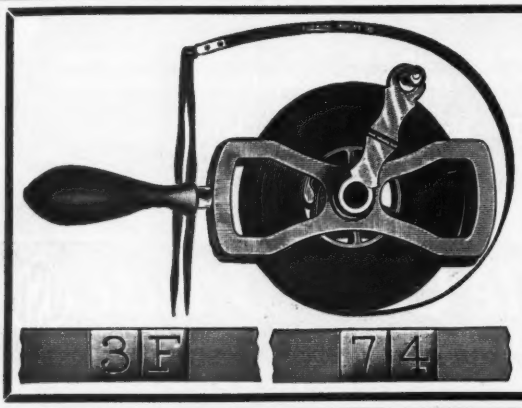

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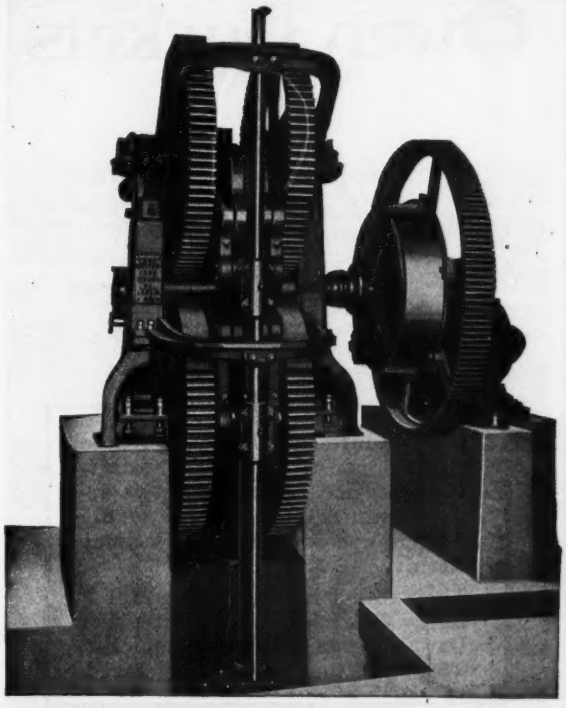

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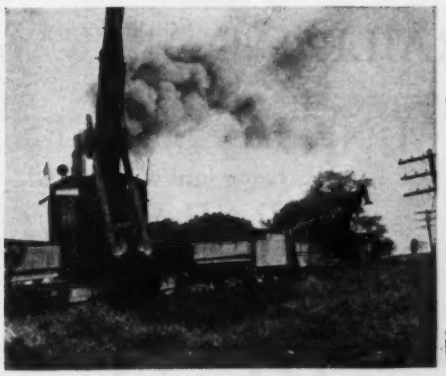

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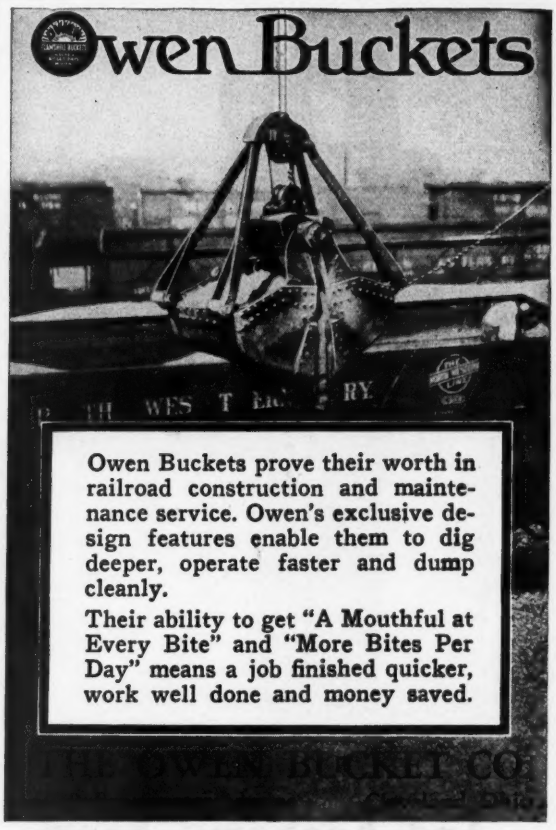

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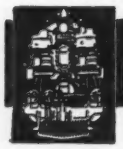

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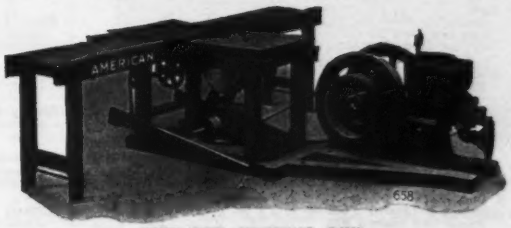

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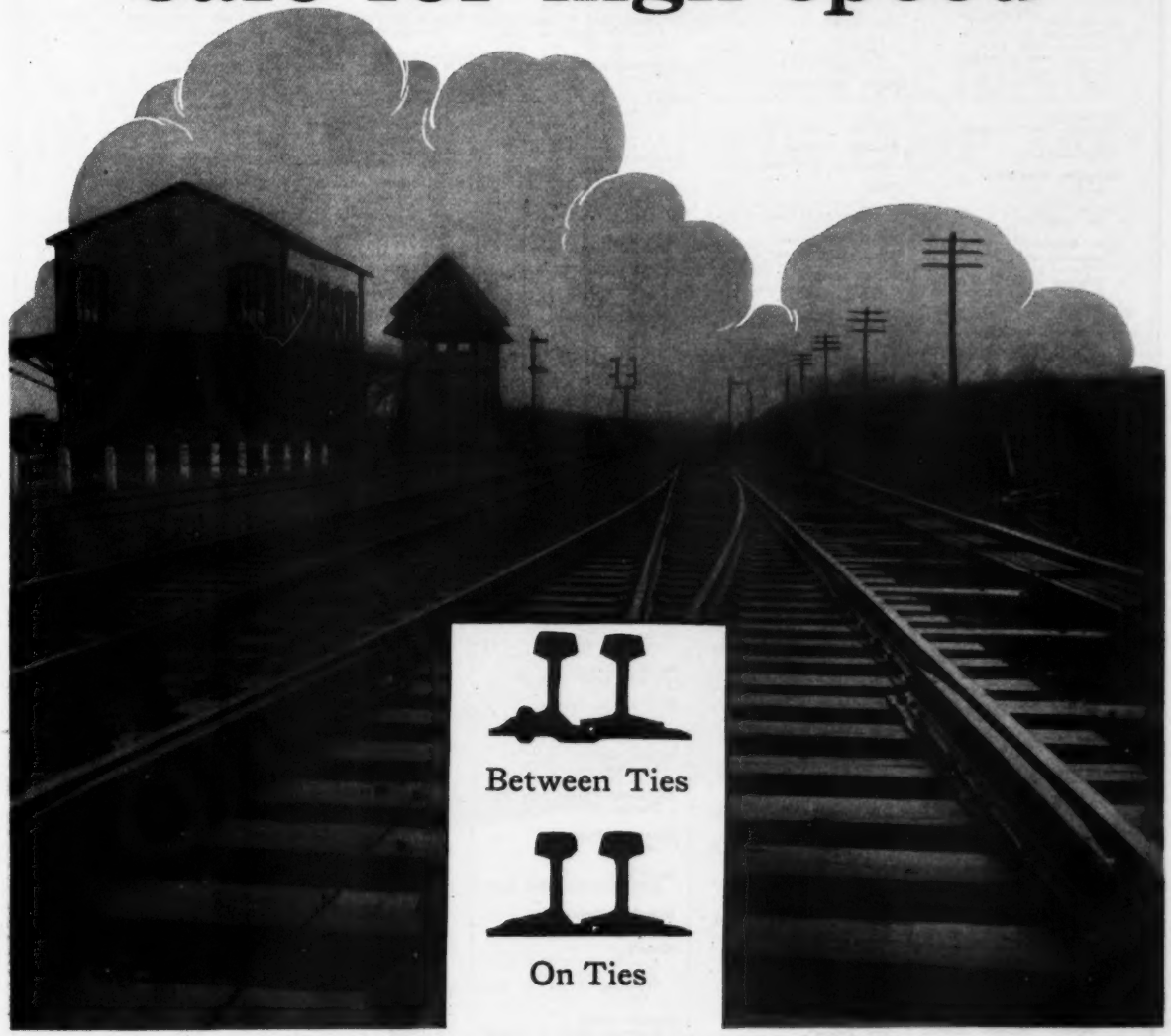

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Woodings Forge & Tool Co.

Shovels, Steam
American Hoist & Derrick Co.
Northwest Engineering Co.

Skid Excavators & Dredges
Northwest Engineering Co.

Skid Shoes
Q. & C. Co.

Snow Melting Device
Lundie Engineering Corp.
Q. & C. Co.

Snow Plows
Jordan Co., O. F.
Q. & C. Co.

Spades
Ames Shovel & Tool Co.

Spikes
Bethlehem Steel Co.
Illinois Steel Company

Spike Pullers
Louisville Frog, Switch & Signal Co.

Spreader Cars
See Cars, Spreader

Spreaders, Ballast
See Ballast Spreaders

Stands, Switch & Target
Bethlehem Steel Co.
Louisville Frog, Switch & Signal Co.
Q. & C. Co.
Ramapo Ajax Corp.

Steel, Alloy
Central Alloy Steel Corp.
Illinois Steel Company

Steel Cross Ties
Carnegie Steel Co.

Steel, Electric Furnace
Timken Roller Bearing Co.

Steel, Open Hearth
Timken Roller Bearing Co.

Steel Plates and Shapes
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Steel, Special Analysis
Timken Roller Bearing Co.

Step Joints
See Joints, Step.

Structural Steel
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Switch Guard
Louisville Frog, Switch & Signal Co.
Ramapo Ajax Corp.

Switches
Bethlehem Steel Co.
Louisville Frog, Switch & Signal Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Switchpoint Protectors
Maintenance Equipment Co.

Switchstands & Fixtures
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Tampers, Tie
See Tie Tampers

Tapes, Measuring
Lufkin Rule Co.

Tee Rails
See Rails, Tee.

Telegraph Service, Long Distance
American Telephone & Telegraph Co.

Telegraph Poles
See Poles

Telephone Service, Long Distance
American Telephone & Telegraph Co.

Testing of Materials
Hunt Co., Robert W.

Thawing Outfits
Lundie Engineering Corp.
Q. & C. Co.

Ties
Jennison-Wright Co.
Prettyman & Sons, J. F.

Tie Plate Clamps
Q. & C. Co.

Tie Plates
Bethlehem Steel Co.
Illinois Steel Co.
Louisville Frog, Switch & Signal Co.
Lundie Engineering Corp.
Sellers Manufacturing Co.

Tie Rods
Bethlehem Steel Co.
Louisville Frog, Switch & Signal Co.

Tie Scorer
Woolery Machine Co.

Tie Spacers
Maintenance Equipment Co.

Tie Tampers
Chicago Pneumatic Tool Co.
Electric Tamper & Equipment Co.
Ingersoll-Rand Co.
Syntron Co.

Tile, Roofing
Federal Cement Tile Co.

Timber
National Lumber Mfrs. Ass'n
Southern Cypress Mfrs. Ass'n.

Timber, Creosoted
Jennison-Wright Co.
Prettyman & Sons, J. F.

Tools, Drainage
Ames Shovel & Tool Co.

Tools, Oxy-Acetylene Cutting & Welding
Oxweld Railroad Service Co.

Tools, Pneumatic
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Tools, Track
Ames Shovel & Tool Co.
Maintenance Equipment Co.
Verona Tool Works
Woodings Forge & Tool Co.

Tongue Switches
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wharton Jr. Co., Wm.

Torches, Oxy-Acetylene Cutting & Welding
Oxweld Railroad Service Co.

Track Braces
See Braces, Track

Track Cranes
Buckeye Traction Ditcher Co.

Track Drills
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Buda Co.
Kalamazoo Railway Supply Co.
Louisville Frog, Switch & Signal Co.

Track Insulation
Q. & C. Co.

Track Jacks
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Track Levels
Kalamazoo Railway Supply Co.

Track Liners
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Track, Special Work
Louisville Frog, Switch & Signal Co.
Ramapo Ajax Corp.
Wharton, Jr., & Co., Wm.

Track Tools
See Tools, Track

Trucks, Hand, Steel
Anchor Post Fence Co.

Tubing, Seamless Steel
Timken Roller Bearing Co.

Ventilators
Q. & C. Co.

Water Treating Plants
Dearborn Chemical Co.

Waterproofing Fabrics
Lehon Co.

Weed Burner
Fairmont Railway Motors, Inc.
Woolery Machine Co.

Weed Killer
Chipman Chemical Engineering Co., Inc.
Q. & C. Co.

Welding & Cutting Equipment
Electric Railweld Service Corp.
Oxweld Railroad Service Co.

Welding, Electric
Electric Railweld Service Corp.

Welding, Oxy-Acetylene
Oxweld Railroad Service Co.

Wheels, Hand & Motor Car
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

Wheels, Wrought Steel
Carnegie Steel Co.

Wire Fencing
American Steel & Wire Co.
Anchor Post Fence Co.
Cyclone Fence Co.
Page Fence Association

Wood Preservation
See Preservation, Timber

Wood Working Machinery
American Saw Mill Machinery Co.

A Reflection Of An Age-Old Engineering Principle In Modern Tie Plate Manufacture

SELLERS
Arched Bottom
Wrought Iron
Tie Plate

10% Stronger or 10% Lighter

THERE can be no argument about the strength of an arch as compared to a flat truss containing the same amount and kind of material.

Likewise there is no argument about the greater strength of Sellers Arched Bottom Wrought Iron Tie Plate, compared with the flat bottom tie plates. Save 10% in metal or use the same amount of metal and have a 10% stronger tie plate—SELLERS.

SELLERS MANUFACTURING COMPANY
ILLINOIS MERCHANTS BANK BLDG., CHICAGO, ILLINOIS

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LEADERSHIP

Claims of leadership can be made, and often are made, without sufficient proof to justify them.

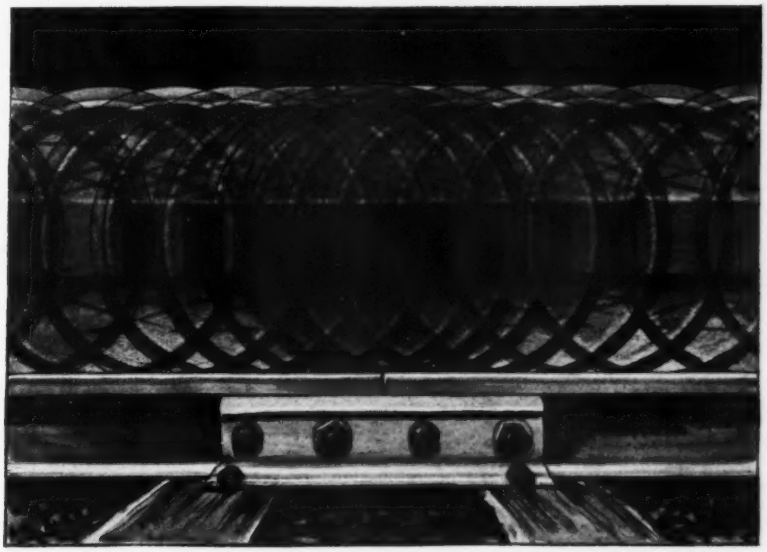
We believe that the following three facts are substantial evidence of real leadership:

First: The majority of the railroads of this country have adopted Improved Hipower.

Second: Most of the roads that try them use more each year.

Third: The number of roads using Improved Hipower is steadily increasing.

This leadership is due to the many points of Improved Hipower superiority which we are taking up one by one in our advertisements this year.



There are many points of Improved Hipower superiority. This is point of superiority No. 10

LONGER LIFE *for* RAILS *and* JOINT BARS

THE life of rails, joints, bolts and nuts depends mainly upon the wear to which they are subjected. Where no spring washers are used the constant impact of traffic loads results in battered rail ends and in worn and damaged joint bars, low joints, loose connections, etc. The spring washer that effectively snubs all impacts of traffic within the smallest distance reduces to a minimum this costly wear.

It is true that spring washers can be made that will permit even more reactive range than any now sold but such spring washers would *extend the area of wear* even though they might eventually snub the impact. Improved Hipower by its great reactive power *limits this wear area more than any spring washer made.* It lengthens the life of rails and joint parts; it requires less upkeep cost. That is why it saves thousands of dollars daily for railroads.

There are many other points of superiority. Our advertisements will announce them.

THE NATIONAL LOCK WASHER COMPANY
Newark, New Jersey, U. S. A.

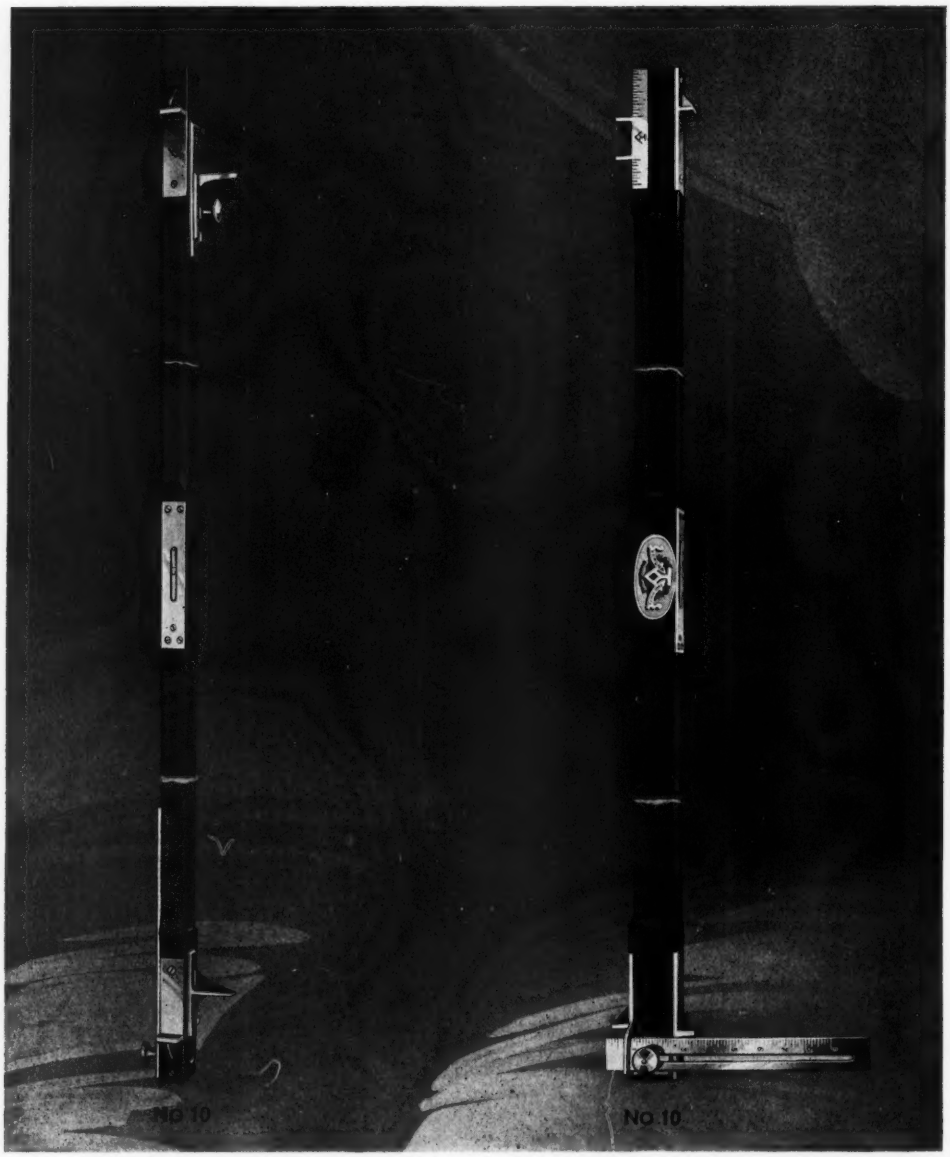
IMPROVED HIPOWER

Commercially Non-flattenable - - Permanently Rust-Proof

VERONA No. 10
INSPECTORS LEVEL AND GAUGE

(PATENT PENDING)

A Precision Instrument for Supervisory Officials Use



AN ALL PURPOSE TOOL:—

Track Level — Track Gauge with Guard Rail Lug
Elevation Scale — Wheel Gauge
Master Gauge for Testing Other Gauges
Oak - Redwood or Mahogany — Solid Brass Parts

VERONA TOOL WORKS, Pittsburgh, Pa.